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THE MICHIGAN CONVENTION.

That the Michigan convention at Grand Rapids last week was a success it is only necessary to state that the association has enjoyed an increase in membership of 100 per cent the past year. A number of live, important topics were discussed. The convention was especially notable for the amount of information brought out on the performance of tungsten series street lamps. While the first of these lamps do not seem to have given anywhere near the life expected, there is much improvement. The same thing seems to be true of the tungsten multiple lamps for indoor use. That the tungsten lamp, when its manufacture is perfected, will have a very long life at commercial efficiencies there seems to be no doubt. At present it has been found advantageous to use the lamps at a lower efficiency in order to secure long life. As might be expected from President Hillman's personal interest in the electric-heating field, considerable attention was given to electric-heating topics. Reports from various central-station companies apparently sum up the situation in electric heating about as follows: The electric flatiron is well established in popularity with the public and is a good revenue-earner for the central station. No other electric heating device seems to approach the iron in revenue possibilities and popularity, but there are a number of electrical conveniences which help to popularize electric service and add small amounts to central-station revenue. The present tendency of central-station companies is to push smaller devices, such as chafing dishes, water heaters and coffee percolators, rather than complete cooking outfits, the complete cooking outfit not being considered to be in an entirely satisfactory commercial stage of development. The use of the so-called fireless cooker or hay-stove principle in connection with electric heating units promises much in the way of increasing the economy of baking, roasting and other cooking usually done in an oven. The electric oven as at present constructed is entirely too expensive to operate.

Another interesting discussion was indulged in as to the possibility of reducing the investment necessary to make service connections with very small residences, by doing away with the meter and using some kind of a regulator or controller to prevent the use of a larger maximum load than that contracted for. The convention delegates were given a practical demonstration of one of the finest pieces of special lighting of downtown streets in existence in this country. By means of arches of 60-cp series tungsten lamps suspended from span wires stretched from building to building across the street every 100 ft., the impression is produced at night that Canal Street has a canopy or roof over it studded with lamps. That the street illumination is ample, to say nothing of the artistic effect, is evident from the fact that there is an expenditure of energy of about one-eighth watt per square foot of street. The general illumination of the street is, in fact, almost as good as inside some of the buildings along the street. Of the engineering features

at Grand Rapids, the extensive application of electric power to factories attracted much interest, but the crowning feature of interest was the 110,000-volt transmission line over which energy for operating these numerous factories is now being sent.

Gas Engine Rating.

In this issue appears the first of a series of articles descriptive of electrical generating plants employing the internal-combustion heat engine as a prime-mover, which series will also include accounts of some plants equipped with gas producers. That the use of the gas or oil-engine for electrical generation has passed the pioneer stage is evident from the large and rapidly growing number of central-station and power plants thus equipped. Indeed, it is not too much to say that the era of the gas-engine has been definitely ushered in, and that henceforth no plans involving the generation of power can be adequately formulated without its serious consideration as a factor. In view of this situation it is desirable that the present unsatisfactory ways of expressing the efficiency of operation of the gas-engine should be replaced by a standard method.

With the calorific value of different gases ranging from 100 lb. to 1000 lb.-Fahr. thermal units per 1000 cu. ft., it is absurd to express the efficiency on the basis of volume consumption of gas, even if the volume is reduced to a standard pressure, which presumably is rarely done. Again, to express efficiency in terms of pounds of coal per horse-power-hour also falls short of being satisfactory, for in the first place the thermal value of combustible per pound of fuel ranges from 10,000 or less, to 15,000 lb.-Fahr. units; and in the second place, this would necessitate for comparative purposes a reduction of natural and illuminating gas to a coal fuel basis. The obvious escape from these difficulties lies in adopting as a basis the thermal value of a gas reduced to a standard gas pressure. But here again another difficulty arises, namely, the determination of the thermal value of a gas; this, however, should be a much simpler process than determining the thermal value of a coal, which is now done as a matter of routine by some users of large amounts of fuel.

Finally, the question of horse-power crops up. This fortunately admits of a relatively simple solution in the case of an engine driving an electrical generator, since the equivalent of the brake-horse-power may be obtained to a high degree of accuracy from a curve showing the relation between the electrical output and the mechanical horse-power at the axis or pulley, which curve can be supplied by the manufacturer or determined once for all by a test after installation. The above considerations appear to call for some action in the near future having for an object the establishment of an authoritative definition of gas-engine efficiency and the means for determining the same; and the practical desideratum is not so much a method for securing high accuracy in the determination of efficiencies as one which will render such efficiencies comparable regardless of the kind of fuel used. In the meantime the data serving as the basis of claims as to the absolute or comparative efficiency of internal-combustion engines can justly be regarded as falling far short of the accuracy of the corresponding data of the steam engine.

Graphical Diagram of Synchronous Condenser Ratings.

An application of the graphical diagram for representing alternating-current phenomena wherein the diagram shows its superiority over the analytical representation for demonstration purposes is found in the determination of the rating of synchronous condensers for certain duties. Although the mathematical expression of the rating of a condenser for changing the power-factor from a certain low value to a satisfactory high value is not extremely complicated when use is made of trigonometric relations, yet the exact physical significance of the several components of the expression is not clearly shown unless each step taken in deriving the result is demonstrated diagrammatically. When all of the steps are indicated simultaneously, one obtains a diagram devoid of complication which can be considered primarily as representing the trigonometric relations, and secondarily as referring to certain electrical quantities.

Thus, of all of the mathematical representations for the physical relations in the synchronous condenser, the trigonometric is the simplest and most satisfactory; when trigonometric expressions are used, it is convenient and desirable to employ combination graphical diagrams, which diagrams incidentally possess the added advantage of showing at once all of the desired electrical relations. An article by Mr. F. C. Helms, on page 442 of this issue, describes a graphical diagram of the above nature that possesses many interesting features. The chief advantage in such a diagram resides not so much in the fact that it can be used to derive approximate numerical results directly, as in the information which it imparts concerning the involved electrical relations and in the more important fact that the exact mathematical expression for any desired result can be obtained without causing one to lose sight of the real physics being dealt with.

Three-Phase Power Factor by Single-Phase Wattmeter.

Although the three-phase system is now 20 years old and has spread its wires over the civilized world, it has a power-factor whose mystery enjoys perennial youth, and is constantly being lost and rediscovered. The power-factor of a single-phase, alternating-current system languishes in neglect, because there is no mystery about it. Given suitable and properly calibrated instruments—namely, a voltmeter, an ammeter and a wattmeter—we can make any simple single-phase system give up its power-factor at short notice. The product of the voltmeter and ammeter readings gives us the apparent power in the circuit. The simultaneous wattmeter reading gives us the real power delivered or dissipated. The ratio of the latter to the former is the power-factor. Simplicity herself could hardly be simpler. But connect three alternating circuits together, delta fashion, with phase differences of a third of a cycle, so as to produce a three-phase system, unbalance the voltages and loads, and we at once are plunged into trouble. In a star three-phase system the difficulty disappears, because the same operation of voltmeter, ammeter and wattmeter-readings, thrice repeated, will give the total volt-amperes and total watts, if the system is only sufficiently obliging to stay steady while the measurements

are being repeated from wire to wire. But in a delta three-phase system, the voltmeters have to be applied to the sides of the system, while the currents observed are the vector sums of the currents due to the voltages so measured. Fortunately, the now well-known two-wattmeter method was discovered, by means of which it became possible to read off the total power in any three-phase system, balanced or unbalanced, as the sum of two simultaneous wattmeter readings. The total apparent power is not so easily measured.

The article by Mr. Nicholas Stahl, which we print this week, discusses the subject anew in a very satisfactory and practical way. Three methods are recommended for determining three-phase power-factors. The first method is that of the divided wattmeter, the current coil being in one wire, and the pressure coil across the other two. For constant volt-amperes, this is a very convenient plan. Unfortunately, it is only in certain special tests, like those described in the article, that the volt-amperes are kept substantially constant. Nevertheless, the method is well worth remembering, although the sine formula, on which it depends, has already been pointed out. The second method, illustrated graphically for balanced systems in Fig. 8, and covered by the tangent formula, is already a well-known two-wattmeter method in fairly extended use. It certainly deserves to be widely recognized. The third method, graphically represented in Fig. 10, appears to be new, and is another modification of the same two-wattmeter method and formula. It requires a new diagram for every new pair of observations, but it has the advantage of enabling the power-factor to be read off directly from the diagram when completed, and does not demand any knowledge of algebra or trigonometry. A ruler, a pair of dividers and squared paper are all the apparatus required. This method should prove distinctly advantageous for factory use. To the student who may have been appalled by the quantity of literature on polyphase measurements which has been printed in recent years, the article by Mr. Stahl can be safely recommended as a most satisfactory résumé of the subject.

RECENT PROPOSED DEFINITIONS OF THE GERMAN ASSOCIATION OF ELECTRICAL ENGINEERS.

A recent number of the *Elektrotechnische Zeitschrift* contains some interesting suggested definitions and terms proposed by a committee of the German Association of Electrical Engineers, as abstracted in the Digest this week. Excellent distinctions are made between voltage, potential and electromotive force. Voltage, or electric pressure, is in brief defined as that electrical property of two points in space whereby work must be done in carrying an electric charge from one to the other. If this work is independent of the path selected, as, for instance, when the points considered are the free terminals of a voltaic battery on open circuit, then the voltage may also be described as a potential-difference. If, however, the work depends upon the path selected, as, for instance, when the points considered are on a copper disk in which eddy currents are flowing, then, although the voltage exists, yet it becomes incorrect to speak of a potential difference. A voltage difference is defined, in brief, as a difference of two voltages, whether a potential-difference does or does not exist. Finally, an electromotive force is virtually defined as the capacity of an electric source for generating voltage, or that which gives rise to electric pressure. In general, in a closed path it is the sum of the voltages developed between successive pairs of points along and completing the circuit. At first sight, it might seem as though such definitions were unnecessarily fine and hairsplitting, from the electrical engineering standpoint; but, on general principles, it is well to err on the side of accuracy, rather than on the side of inaccuracy, when making definitions of physical terms for the use of engineers. A physicist giving his whole time and attention to scientific study is less likely to be misled by careless definitions and loose terminology than the engineer, whose business it is to apply the science to workaday needs. Errors in terms and in definitions are likely sooner or later to hatch out in the mind of a practical man as errors in conception or in action.

Another suggestion offered is in connection with conductance, which is defined as the reciprocal of resistance. The unit in the practical magnetic system is provisionally christened the "Siemens" and the symbol assigned to this unit is *S*. Hitherto, conductances in the practical system have been very commonly expressed in terms of the unit "mho" or *ohm* spelled backward, to indicate the reciprocal of the quantity. This liberty with the name of Ohm is attributed in the first instance to the late Lord Kelvin. The mho had had the advantage in the past of being practically self-explanatory to electricians, once they knew what an ohm meant, and the inverse relation between resistance and conductance. In other words, the mho saved the necessity of learning a new name for the conductance unit. We think it is a pity that our German confrères have been struck with any unintentional mutilation on the name of the great physicist Ohm that the term mho may be capable of suggesting. From one standpoint it would seem, on the contrary, that a double honor was done to the name by utilizing it backwards as well as forwards. We think that in the worldly mind of a business advertiser, bent on lauding Ohm, the idea of the mho would elicit a pæan of joy and admiration.

Of course, there can be no question as to the justice of any claim for the recognition of the name of Siemens in electric science. In the first place, however, Siemens has already had his name given to the Siemens unit of resistance. In the second place the objection to the new Siemens proposal is that the name in this new connection comes as an unnecessary burden. Every student would have to learn the word Siemens as the unit of conductance, whereas no student has to learn the meaning of the word *mho* once he has grasped its significance. It is one of the few things no student ever forgets. On the other hand, there are other physical quantities in electrical engineering, of rising importance, that at present have no name, but yearn for one. It would be much better to use the name of Siemens for such an one, where it would be a welcome blessing, than to put it where it fills no urgent need. Consequently, with every veneration for the great work of the Siemens family, we cannot help hoping that this particular suggestion may not receive final adoption. Another definition offered is the thermal value of the 15 deg. C. gramme-calorie, namely, 4.189 joules. The last figure, i. e., the 9, has long been under discussion. The German committee presents its estimate of its proper value at the particular temperature of 15 deg. C.; or the work required to raise 1 gramme of water through 1 deg. C. at that temperature, based upon a number of different researches.

Regulation of Wireless.

A writer in the July number of the *Post Office Electrical Engineers' Journal* (London), in commenting on an article which appeared in the April number of *Edinburgh Review*, entitled "The Politics of Wireless," discusses the practicability of the regulations recommended by the International Radio-Telegraph Convention, held in Berlin last year. The wireless telegraph engineer, he says, will recognize that, contrary to what might be expected, it is not easy to bring the aims of the convention satisfactorily into operation. The subject has a complexity peculiarly its own, especially on the technical side—a complexity which has perhaps been imperfectly appreciated even by those who framed the terms of the convention articles. To take one aspect of the case, a fundamental object is to provide such a scheme of operation and organization as shall enable the greatest utility to be obtained in the field of radio-telegraphy. To this end it is imperative that undue interference between stations be guarded against. In this relation the convention and its appended service regulations make provision under three heads, as follows:

(*a*) Limitation of the electrical power taken by the radio-telegraphic plant.

(*b*) Limitation of range of wave lengths to be used for specified kinds of communications and a specific wave length for a certain specific purpose.

(*c*) Use of "syntonized" or "tuned" systems only.

With regard to the first provision it is to be noted that though the power used is a factor in determining the amount of disturbance produced in the ether by the operation of emitting electric waves, it is by no means the only, nor perhaps the most important, factor. The same limit of power is to be observed for all types of transmitting appliances, and in this respect alone there is scope for the production of almost unlimited disturbance. The antenna may be high or low, an effective and powerful or a poor and feeble radiator even with the limits of wave-lengths and syntonization prescribed. It is conceivable that an effective type of transmitter could be used which would efficiently convert the low-tension electrical energy from the source directly into effective high-frequency oscillations, thus avoiding the usual transformation and other losses which account for the absorption of by far the greater part of the energy used. For instance, an electrostatic machine of efficient design driven directly by a 1-kw motor would furnish a means of producing prodigious disturbance, though it might not lend itself well to signaling purposes. But more important still is the fact that the disturbance produced is an inverse function of the rate of sparking, and that a system absorbing 1 kw of electrical energy may, by a scheme of slow laborious discharges, release Jove's very thunderbolts at each spark. Such a system, if utilized for, say, the transmission of messages over long distances, would constitute a grave menace to all other stations within its range using approximately its wave-length, not only in virtue of the heavy disturbance produced, but by reason of the prolonged period which would be occupied in spelling out its tedious messages.

There is also the question of how this limitation of power is to be observed in such cases as the supply of energy direct from the mains of an existing electric installation for lighting and power purposes, or even the simple case of power taken direct from accumulators. In both instances there are practical difficulties in the way of ensuring that power very considerably in excess of the stipulated amount is not drawn, very probably in ignorance on the part of the operator or other responsible official, of the meaning of the expression "electrical power." The idea of fuses and cut-outs will no doubt occur to the practical engineer in this connection, but these devices as often as not quickly fall into disuse in the absence of a systematic overhaul and inspection, perhaps for no other reason than that they are a source of some occasional trouble, or because it is not apparent that they are essential to the good working of the station. A number of other factors also enter into the question of power limitation which would occupy too much space to discuss fully, but it will readily be seen that simple legislation for a stipulated limit of power is not by any means all that is required to check undue interference.

The second provision mentioned above, viz., wave-length limitations, is more effective, so far as the avoidance of interference between stations having different ranges of wave-lengths is concerned. The wave-lengths used for naval purposes may, for instance, be entirely outside the scale of wave-lengths allotted to commercial stations and the mercantile marine, thus in general ensuring a strictly limited interference area as between the two distinct systems. It will be observed, however, that this provision does not touch the question of interference between stations having the same scale of wave-lengths allotted to them. Fine discrimination in the allocation of wave-lengths is, moreover, at present a matter of impossibility, in the absence of a definite standard of wave-length measurement. No doubt this weakness will shortly be rectified.

The third provision is open to the objection that it is extremely difficult to specify what is and what is not a "syntonized" system. "Syntonized" and its co-related "resonance" are the very life and soul of all radio-telegraphy. Without invoking the aid of resonance effects and syntony it is not too much to say that high-frequency oscillations would not be amenable to the purposes of radio-telegraphy. Hence every system of radio-telegraphy extant is a syntonic system, and capable of being "syntonized." It is only a question of the degree to which this property is possessed that can differentiate a so-called "untuned" from a "tuned" system, and in this fact lies an obstacle to the introduction of an entirely satisfactory definition of the term. Without some kind of definition the provision is of course quite futile. Again, the syntonization of radio stations to one another is mutual, that is, it is a joint function of the transmitter at the one station and the receiver at the other, and the degree of syntony is therefore determinable equally by the transmitter or the receiver.

Strictly speaking, therefore, there should be a definition of a syntonized transmitter and a syntonized receiver. In this lies a possibility which appears to commend itself for adoption in lieu of a simpler and less involved definition, viz., that a transmitter be regarded as syntonized when the closed oscillatory circuit is coupled to the aerial system to just such an extent that under the best working conditions maximum range of communication is obtained, and that a receiver be likewise so regarded when its closed oscillatory circuit is coupled to the aerial system only to the extent necessary to ensure maximum range of communication. To make this clear it should be explained that the degree of coupling determines the freedom, or rather want of freedom, of the oscillatory circuit, and therefore the want of persistency of the waves generated in each train of an impulse, that is, the less the coupling between the oscillatory circuit and the aerial system the greater the persistency of the train of waves, and the sharper the tuning obtainable. The amplitude of undulation of the waves also suffers, however, so that a point is quickly reached when any weakening or lessening of the coupling reduces rather than increases the range of communication. It is true that in some transmitting systems there is no separate oscillatory circuit, the aerial system itself being made to fulfil the purpose. These would require to be specially dealt with from the point of view that they would be restricted to operate with only such power as would determine an interference no greater than that from a transmitter with coupled oscillatory circuit, properly adjusted.

So far interference between stations has been dealt with mainly as a question of amount of disturbance imparted to the ether. But to make a complex question yet more complicated it has unfortunately to be recognized that the disturbance in the ether is only one factor in the interference problem. Disturbance may be defined as the maximum amplitude of wave-undulation generated. Interference between stations depends also on:

(*a*) Characteristics of wave-transmission.

(*b*) Characteristics of receiver.

(*c*) Location and proximity of stations.

With regard to (*a*) the length of wave has some bearing on the matter as long waves have a greater range than short ones, and some types of wave detectors are more responsive to long waves than short, and vice-versa. Thus, the magnetic and electrolytic detectors are more responsive to long waves than the carbon steel and other detectors of the coherer type. The damping coefficient has also to be taken into account in that it affects the "percentage freedom" due to difference of tune. Next, and by no means least, is the intermittency factor, that is, the rate of succession of wave-trains emitted. With the auditive receivers now in general use the note due to the particular intermittency of the transmitter is quite distinctive, so that it is possible to read the signals from a particular station irrespective of other and possibly stronger signals audible from another station using the same wave-length, interference being in this way very greatly minimized. This feature becomes especially pronounced where rapid rates of sparking, which produce distinctive notes in the receiver, are concerned.

In all such cases, however, thoroughly practised and expert operators are necessary to enable accurate and safe transmission to be accomplished under these conditions of interference.

With regard to (*b*) there are still more factors concerned, such as sensitiveness of receiver, degree of susceptibility to tuning, maximum amplitude required to effect response under specified degrees of dissonance of tune, method of response (auditive or recording), etc. In the continuous wave-systems which are now being developed there are yet other aspects of interference to be dealt with. The Peddersen "tikker" receiver owes its sensitiveness quite as much to its property of making use of a very long series of waves and storing the energy by cumulation as to its degree of susceptibility to tuning.

Directive systems of wireless telegraphy are also in course of development, and one at least is of such a nature that in a specified direction no interference whatever results. In other directions the interference varies with the angle to the direction of *nil* radiation.

Transmitters using coupled oscillatory systems emit subsidiary waves differing in length from the main effective wave. Likewise coupled oscillatory circuits in the receiver exhibit a degree of responsiveness to certain waves differing in length from those effecting the main response. Transmitters in which the aerial system is precharged and is the only part in which oscillations take place and receivers used directly in the aerial system are free from this defect, but introduce others which may in certain circumstances prove even more troublesome.

The precharging of the aerial introduces trouble due to electrostatic induction over a certain range, similar to the interference produced by atmospheric electrical disturbances against which tuning is not altogether effective, because the conductors affected will always oscillate at their own particular fundamental rate whenever the electrostatic induction is suddenly diminished or suddenly increased. For this reason although subsidiary waves are not inherent to transmitters using precharged aerials, they are doubtless liable to set up subsidiary waves by causing other conductors in the proximity, or even in the station itself, to emit waves.

That the location of a station with regard to the nature of its surroundings, hills, foliage, etc., will have an important bearing on the interference in different directions will be obvious.

Enough has perhaps been said to indicate the nature of the problems which have to be faced and much more thoroughly investigated than has yet been done if anything like exactitude is to be aimed at in defining interference between stations. To interpret and apply the terms of the International Convention in a reasonable and just manner involves a close engineering knowledge of the art, and the matter will require delicate handling. The convention itself does little more than touch the fringe of the subject, and it is on its intelligent and reasonable interpretation that its usefulness will to a large extent depend.

Niagara Energy for Ontario.

Reference has been made in our columns from time to time to the plans of the Hydro-Electric Power Commission of Ontario for transmitting energy to the Province from Niagara Falls. We are now able to record the awarding of the contract for building the transmission lines for the commission to the McGuigan Construction Company. The head of this company is F. H. McGuigan, formerly fourth vice-president and chief superintendent of the Grand Trunk Railway Company and of the Great Northern Railway Company. The McGuigan Company is to build the lines specified for $1,270,000, and if called upon by next February to construct another set of lines of equal length it is to do so at the same rate. The total length of line to be built at the present time is 293 miles. It is to radiate from Niagara Falls in two directions—westward to St. Thomas and eastward to Toronto. It is to be completed by December 1, 1909. Tenders came from companies in the United States and in the United Kingdom, some being for the towers, others for the aluminum cable, others for the erection of the line. Of the 27 tenders only one other was like the McGuigan Company's, for the whole work. This company's tender was less by $250,000 than the commission's estimate of the cost.

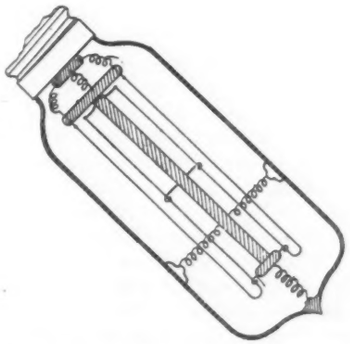
The towers, 3176 in number, are to be 66 ft. high, 7340 tons of steel being required for their construction. They are to be manufactured by the Canada Bridge Company, Walkerville, Ont., and by the Ontario Iron & Steel Company, Welland, Ont. Of aluminum cable, 1,014,209 lb. will be used. This will be made by the Northern Aluminum Company of America, in its work at Shawinigan Falls, Que. The contractor undertakes upon due notice not only to double the mileage at the same rate, but also to furnish at the contract prices from 50 to 125 tons additional of aluminum cable for the construction of low-tension lines. This is to provide for any extensions that may be desired from municipalities on the high-tension lines to neighboring towns and villages.

Copper-Titanium Arc-Lamp Electrode.

A patent was issued Aug. 18 to Isado Ladoff on arc-lamp electrodes containing copper and titanium. Excellent results are stated to have been obtained with an alloy of copper, with 6 to 8 per cent of titanium for the positive electrode. The negative electrode may be composed of an alloy or other combination of iron and titanium, such as the oxides of these metals.

Elastic Suspension for Metallic Filaments.

The accompanying illustration shows a form of elastic suspension for the metallic filament of an incandescent lamp, for which a patent was granted August 18 to Paul Druseidt, of Remscheid, Germany. A glass carrier for the filament spiders



ELASTIC SUSPENSION FOR METALLIC FILAMENTS.

is supported at each end by spiral springs, and the leading-in wires are connected to the filament by the intermediary of a spring or similar flexible arrangement. Side supporting springs

may also be used, as shown. It is stated that the springs have a cushioning effect upon the filaments and greatly lengthen the life of the lamp, particularly as they absorb vibrations and prevent friction and breakage of the filaments in their retaining elements or hooks. For this reason a larger number of retaining hooks than at present employed can be advantageously used.

Convention of the Michigan Electric Association.

The Michigan Electric Association held its fifth annual convention at the Hotel Pantlind, Grand Rapids, Mich., Aug. 18 to 20, 1908. As a result of vigorous efforts on the part of President Hillman, with the co-operation of electrical traveling men of the State, a large increase in membership and attendance was noted this year.

Mr. H. W. Hillman, who was elected for a second term as president of the association, is sales manager of the Grand Rapids-Muskegon Power Company, of Grand Rapids. He was born at Manchester, N. J., in 1870, and most of his early life was spent at Northampton, Mass. Mr. Hillman left school at the age of 12 and went to work. He passed through various departments of Belding Brothers & Company's silk factory at

H. W. HILLMAN.

Northampton; later he was associated with the general manager of that mill and with the secretary of the company, and finally was promoted to the Boston office. For 17 years he has been connected with the electrical industry, mainly through the General Electric Company. He was first connected with the Boston office of that company, later going to New York and finally moving to Schenectady. He was in charge of the arc-lighting department of that company before the enclosed-arc lamps became generally used, and was especially interested in the introduction of the series-alternating enclosed-arc system with constant-current transformers. Before leaving the General Electric Company he organized and handled its heating department. The great interest exhibited at all recent conventions by central-station managers in connection with heating devices is gratifying to Mr. Hillman as showing that some of the work he has done in pushing the electric heating business is bearing fruit. He is a member of the American Institute of Electrical Engineers, National Electric Light Association and Illuminating Engineering Society. In July, 1907, he severed his relations with the General Electric Company and went to Grand Rapids as sales manager of the power company there. Under his supervision there has been an enormous increase of power and lighting load in Grand Rapids. He has been in charge of the marketing of the great water power owned by that company. As president of the Michigan Electric Association he has brought about during his previous administration of one year an increase of over 100 per cent in membership.

The first session was called to order Tuesday morning with President H. W. Hillman in the chair. The convention was welcomed by Mr. S. A. Freshney, manager of the board of public works. He called attention to some of the things in the electrical line that Grand Rapids is proud of, among these being the only 110,000-volt transmission line operating commercially; a connected load of 250,000 lamps, 16,000 hp in motors and low rates for electric light and power.

This was followed by the president's address. He called attention to the object of the association, which is to promote and foster the common interests of its members in all matters relating to electric light and power companies. The past year has been filled with interesting electrical development designed to advance scientific and practical knowledge in many matters relating to electric light and power. He said that he had recently received communications from 75 different electric companies in the State, which indicate that to date they have purchased nearly 15,000 tungsten incandescent lamps. Electric motors of more than 100,000 hp turn the wheels of industry throughout the State. The heating branch of the industry shows marked progress. The electric flatiron continues to lead in being considered the most popular device by the people and the greatest income earner for the companies. The largest electric heating device manufacturer is at present operating night and day to fill orders, while other production departments are not crowded. Those well acquainted with the motor industry advise that a wise solicitation of factory heating appliances promotes the extension of motor business. He favored the establishment of a new grade of membership to take in supply and manufacturing men as associates. Since last meeting the membership has increased practically 100 per cent.

The papers and discussions of this session were devoted to experiences with tungsten lamps. Mr. E. F. Phillips, of Detroit, described the series tungsten street-lighting installation at Grosse Pointe Farms, near Detroit, described and illustrated in these columns in the issue of Dec. 7, 1907.

Mr. Fred. Masterson, of Grand Rapids, read a short description of a notable installation of 270 tungsten lamps of 16 cp, lighting about 1500 lineal feet of Canal Street in Grand Rapids. This installation excited much interest during the convention, as it is one of the finest pieces of special down-town street lighting in the United States. An arch of 18 60-cp lamps is placed every 100 ft.

Mr. William Chandler read a report by himself and D. B. South on "Some Early Experiences with Tungsten Lamps at Sault Ste. Marie." Mr. H. A. Chase, of Hart, Mich., gave the experience of the municipal plant of which he is manager with the series tungsten lamp for street lighting, which is displacing an older system.

Mr. A. C. Marshall told of the introduction of 60- and 100-watt tungsten lamps in commercial store lighting at Port Huron. An interesting discussion followed, in which Mr. Marshall, Mr. Alex. Dow, of Detroit, and Mr. George D. Westover, of Cadillac, discussed the possibility of securing as customers workingmen's cottages and the smaller class of residences by making a flat rate to such small customers. Mr. A. C. Marshall presented curves showing what this flat rate would mean, and Mr. Westover reported that he had already secured a large number of such small residences without the flat rate and at reasonable investment.

Tuesday afternoon no session was held, but the delegates visited the factory of the Grand Rapids Hand Screw Company, this being one of the notable installations of electric power in Grand Rapids. An automobile ride was provided for the entertainment of the ladies the same afternoon. Tuesday evening the entire party was taken to Romona Park, and after taking in a number of the shows finished at Romona Theater. After the theater a special balloon ascension and parachute drop by searchlight was made for the benefit of the association.

Wednesday morning the president appointed as managing committee Mr. George D. Westover, of Cadillac; Mr. R. W. Hemphill, of Ann Arbor, and Mr. F. E. Koehler, of Grand Rapids. A committee on the president's report was appointed, con-

sisting of Messrs. H. A. Mott, of Jackson; H. A. Chase, of Hart, and George D. Westover, of Cadillac. The secretary announced that the membership last convention was 52, which had been increased to 104 the past year. President Hillman made a brief talk on increasing membership, especially on getting members lower in the ranks than managers and superintendents. There were, he said, a number of foremen and others who could get benefit from the association. Mr. E. F. Phillips, of Detroit, reported progress for the insurance committee.

Mr. E. L. Crosby, of Detroit, read a paper on the subject "Campaigning for Power." Mr. A. C. Harris, of Grand Rapids, described an electric-power installation in a woodworking plant —that of the Grand Rapids Hand Screw Company, visited the day before. This was followed by an extended discussion on allied subjects, participated in by Messrs. Chandler, of Sault Ste. Marie; Biggs, of Detroit; Constable, of Grand Rapids; Alex. Dow, of Detroit, and Dr. C. P. Steinmetz. The secretary read a resolution of the executive committee recommending the election of Dr. Steinmetz to honorary membership. Mr. Dow moved the adoption of this resolution, and in doing so he explained that he favored this action not because of the high scientific attainments of Dr. Steinmetz, but because he had shown himself a good, practical "electric-light man," fully awake to the commercial and business problems of the business and ready to apply his scientific knowledge and powers of analysis to them.

Mr. Guy Lewis, of the Lewis Electric Company, Grand Rapids, read a paper on "The Relation of the Contractor and Central Station." This was followed by a paper on "The Value of Electric Signs" by Mr. John Vandervliet. The relation of the central station to the contracting business was briefly discussed, after which Mr. Mott, chairman of the committee on president's address, reported in favor of the establishment of a grade of associate membership to be open to manufacturers and supply dealers. The convention went into executive session to discuss this matter, and after a lengthy and rather animated discussion it was voted to establish an associate membership by a vote of 7 to 22.

Wednesday afternoon the convention was taken in carriages to a substation in the outskirts of the city, where the 110,000-volt transmission terminates. This transmission line is on steel towers 53 ft. high and about 500 ft. apart. Five-part suspension insulators are used, each disk being 10 in. in diameter and tested to 100,000 volts. The static discharge can be seen in the substation and on the line on dark nights and can be heard at all times in the substation. Wednesday evening Dr. Steinmetz gave an address on "Lightning Phenomena," in which he explained the principles of cloud formation, rain, hail and lightning. His address covered mainly the cause of lightning phenomena without dealing extensively with protection from lightning. He stated, however, at the close, that the art of protecting high-tension transmission lines from lightning discharges was in a much more exact and satisfactory state than a few years ago, when guesswork prevailed. He said that it is now possible to design lightning arresters with the exactness of motors instead of using the cut-and-try method of former years.

Thursday morning session was opened with short talks on securing new membership from President Hillman, Messrs. Chandler, Stevens and Phillips. Papers on electric heating occupied most of the time of this session. Mr. E. L. Callahan read one on "Popularizing the Use of Electricity," which dealt mainly with the introduction of heating devices.

"Electric Heating in Sault Ste. Marie" was the subject of an extended report on the work of the Edison Sault Electric Company, by Messrs. William Chandler and D. B. South. Mr. Johnson, of Schenectady, was called upon to give his experience with electric cooking in his home. "Fireless Cookers" was the subject of a paper by Mr. John Gronberg, general manager of the Fireless Cooker Company, of Grand Rapids. Mr. Walter Bennett, of Detroit, read a report on some extensive tests of electric cooking for a small family carried on by him.

The report of the electric heating committee, consisting of Messrs. William Constable, R. W. Hemphill, Jr., and H. A. Moot, was then read by Mr. Constable. "Electric Display Windows for Effectually Advertising Electricity" was the subject of a paper by Mr. Charles O. Blackford, of Grand Rapids. These papers were discussed by Messrs. R. W. Hemphill, William Chandler and J. R. Cravath. The discussion brought out the fact that there is an increasing use of small motors for household purposes, and that these as well as the small heating devices are popularizing electric service. Abstracts of some of the papers are given elsewhere and others will appear in later issues.

The report of the finance committee showed receipts of $937.81 and a balance of $202.26. The officers elected for the following year were: President, Mr. H. W. Hillman, of Grand Rapids; vice-president, Mr. F. D. Spencer, of Sheboygan; secretary and treasurer, Mr. A. C. Marshall, of Port Huron; executive committee, Messrs. O. S. Wood, of Ionia; William Lowden, of Traverse City, and John F. Collins, of Saginaw; finance committee, Messrs. Alex. Dow, of Detroit; W. R. Collins, of Saginaw, and H. A. Mott, of Jackson.

Thursday afternoon, after the last session of the convention, special cars took the party to Spring Lake, where they were taken by boats from Fruitport to Spring Lake Hotel, where a banquet was served in the evening.

The elaborate entertainment program was carried out by a committee consisting of Messrs. A. L. Searles, H. W. Hillman, W. J. Trott, A. F. Burlingame, H. A. Mott, L. M. Page, J. Noyes and F. E. Koehler.

Convention of International Association of Municipal Electricians.

The thirteenth annual convention of the International Association of Municipal Electricians was held in the convention hall of the Pontchartrain Hotel, Detroit, Mich., Aug. 19, 20 and 21. The attendance was not large, but the delegates present were full of enthusiasm and the discussion on papers read was spirited.

This association had its inception at a small gathering held in Brooklyn, N. Y., in 1896. Since its organization its scope of usefulness has broadened until now it covers the entire field with which municipal electricians have to deal. The five departments into which the work of the members is divided are the Inspection Department, Police Signal Department, Fire Telegraph Department, Electric Light Department and Outside Construction Department. Of these various departments it was cited by Mr. A. S. Hatch, consulting engineer of Detroit, who was one of the originators of the association, that none is more important than the others and each depends upon the others for a successful existence.

The convention was called to order at 10 a. m. on the 19th by the president, Mr. R. A. Smith, superintendent of electrical affairs, Norfolk, Va. After making a few preliminary remarks, he introduced Mr. William B. Thompson, Mayor of the city of Detroit, who welcomed the electricians to the city, not alone because they were delegates to a convention, but also because they were all city officials engaged in a noble work.

First Vice-President J. B. Yeakle, superintendent of fire telegraph, Baltimore, Md., responded to Mayor Thompson's welcome. In a brief way he reviewed the work that has been accomplished by the members for their respective cities through the co-operation of the association.

Mr. A. S. Hatch gave a short historical sketch of the formation of the association and its growth and increased usefulness. He said nearly every city in the United States owning its own electric-light plant is indebted directly or indirectly to the association and the preliminary work done by its members.

The president appointed a nominating committee consisting of Mr. A. S. Hatch, Mr. James Warren, Mr. C. S. Downs, Mr. A. L. W. Kittridge and Mr. John Berry, and a committee on exhibits consisting of Mr. W. Y. Ellett, Mr. M. J. Donahue and Mr. C. G. Lundquist.

In the afternoon President Smith delivered a short annual address dealing with the matters pertaining to the association's welfare. He urged every member to take part during the coming year in a campaign for new members and a more representative attendance at future conventions.

Mr. Smith read a paper on "The Moving-Picture Hazard," which brought out a lively discussion. The paper dealt with the dangers arising from a disregard of the National Code in wiring a building in which moving pictures are to be exhibited and described the precautions taken at Norfolk, Va., to safeguard against fire in moving-picture show houses. Whenever moving-picture machines are operated in any building or tent within the Norfolk city limits they must be so located as not to obstruct the exits, aisles or passages thereto, and are placed in a metal chamber of galvanized iron not less than No. 24 gage, said chamber not to be smaller than 6 ft. square by 5½ ft high, inside measurement. There must be an inner and outer wall with a 2-in. air space between, for sides and top, riveted to a substantial iron framework. There must be a vent pipe not less than 12 in. in diameter running from the metal chamber to a point outside the building. The main door must be hung by stout coiled spring hinges and must swing outward; openings for lens and operator must not exceed 10 in. x 8 in. each, and they must have metal drop shutters running in metal grooves, the shutters to be held open by light cotton strings passing across the inner ceiling of the booth, through the side of the booth to the outside. All wiring in booth must be in conduits, and the wiring for a picture-machine must be separate from the lighting system; all exits must have large signs and red lanterns, burning sperm oil; not less than two 5-gal. chemical extinguishers must be located near the booth. All machines must be in charge of competent men who shall receive a certificate from the board of control, said certificate to be good for only one year and is revocable for cause.

In the discussion that followed it was agreed that care should be taken in wiring show buildings and that the booths for picture machines should be carefully constructed. Mr. Jerry Murphy said a large percentage of the fires occurring in moving-picture show houses have their origin in other than electrical troubles. He thought the fire warden should keep close watch over show houses of this class and should be held responsible for fires originating there. It was stated 90 per cent of fires occurring in moving-picture houses are caused by carelessness on the part of the machine operator and from allowing smoking in the booth.

At the opening of Thursday morning's session, Mr. Walter M. Petty, borough electrician, Rutherford, N. J., read a paper on "Batteries for Signaling Systems" which brought out an interesting discussion on the best method to follow in charging and discharging batteries used on police and fire-alarm circuits. He said he had found it profitable to overcharge the batteries about twice a month. By overcharging oftener than this he had found a sediment will be precipitated in the cells. Mr. Jerry Murphy, Mr. C. R. George, city electrician, Houston, Tex.; Mr. T. C. O'Hearn, city electrician, Cambridge, Mass.; Mr. A. C. Farrand, city electrician, Atlantic City, N. J.; Mr. R. A. Smith, Mr. C. E. Diehl, superintendent fire and police telegraph, Harrisburg, Pa., and Mr. J. B. Yeakle each took part in the discussion and gave a synopsis of his personal experience in handling batteries for police and fire-alarm circuits. Instances were noted where good results were obtained from almost constant and also from long and from short periods of overcharge. No definite decision as to the best method of charging and overcharging was arrived at.

Mr. Jerry Murphy, superintendent of police telegraph, Cleveland, Ohio, presented a paper on "Modern Police Signaling Apparatus." This paper was brief and was presented merely to provoke a discussion on what really constitutes a good police signal system. Opinion was divided as to whether telephone or telegraph systems are the more advantageous. Messrs. A. C. Farrand, W. S. Devlin, T. C. O'Hearn and C. R. George imparted useful information on the subject.

Mr. Hatch, chairman of the electric light committee, gave an informal report on the "Electric Light Department." He said that in looking back over the progress of the street-lighting business a transition period can be detected every successive seven years as follows:

1886.—Transition from the use of gas to the use of open arcs.

1893.—Transition from open arcs to direct-current enclosed arcs.

1900.—Transition from direct to alternating-current enclosed arcs.

1907.—Transition from alternating enclosed carbon arcs to flaming arcs and to high-efficiency metallic-filament incandescent lamps.

He said the introduction of the metallic-filament lamps is a big stride toward better lighting and that the tungsten lamp is a boon especially to the owners of light plants in the smaller cities and towns. Plants producing current at 220- or 250-volt run out three or four lines at a small cost of construction and by connecting the lamps in series provide a very commendable service for the entire town. He predicted that the lighting of streets by electricity will be further simplified from year to year.

Mr. Julius Bernstein, of the Leeds & Northrup Company, of Philadelphia, Pa., presented a paper on "Fundamental Methods of Fault Location." During the reading of the paper the author drew sketches of the devices recommended and made suggestions that could be profitably followed where the wiring conditions include police and fire-alarm boxes or unknown resistances. The paper treated of the fundamentals of testing instruments which are based upon the principle of the Wheatstone bridge.

Mr. C. R. George read a paper on "Electrical Equipment of a Fire Station." He used one of the stations at Houston, Tex., which is under his supervision, as an example and described the up-to-date methods and its modern equipment.

Mr. Hatch in presenting the report of the committee on "Outside Construction" said the committee favored the complete separation of high- and low-tension wires. In order to accomplish this separation it is necessary for city officials to cooperate with the officials of commercial companies. The work will be slow, but, he said, by constant effort it can be accomplished.

At Friday's session a committee was appointed to make protest with the postmaster-general against painting mail boxes red, which color has long been used to distinguish fire-alarm boxes from other public-service boxes located at street corners. It was stated an order that mail boxes shall be painted red has recently been issued by the United States Postoffice Department, which change causes confusion when a fire alarm is to be turned in by an excited citizen.

Atlantic City, N. J., was selected as the meeting place for the convention of 1909.

The following officers were elected for the ensuing year: President, Mr. J. B. Yeakle, Baltimore, Md.; first vice-president, Mr. W. S. Devlin, New Castle, Pa.; second vice-president, Mr. H. C. Bundy, Watertown, N. Y.; third vice-president, Mr. F. A. Cambridge, Winnipeg, Manitoba; fourth vice-president, Mr. C. R. George, Houston, Tex.; secretary, Mr. Frank P. Foster, Corning, N. Y.; treasurer, Mr. C. E. Diehl, Harrisburg, Pa. The following department committees were named: Inspection: Messrs. L. L. Kingsbury, R. A. Smith and T. C. O'Hearn. Police Signal: Messrs. A. C. Farrand, Jerry Murphy and A. L. Kittridge. Fire Telegraph: Messrs. C. F. Gall, S. W. Manning and H. C. Bundy. Electric Light: Messrs. C. A. Lundquist, A. L. Pierce and F. A. Cambridge. Outside Construction: Messrs. W. S. Devlin, William Crane and John O'Brien.

The past presidents of the association and the years which they were respectively incumbents of the office of president are as follows:

1896-7—Mr. F. C. Mason, Brooklyn, N. Y.
1897-8—Mr. W. Y. Ellett, Elmira, N. Y.
1898-9—Mr. J. W. Aydon, Wilmington, Del.

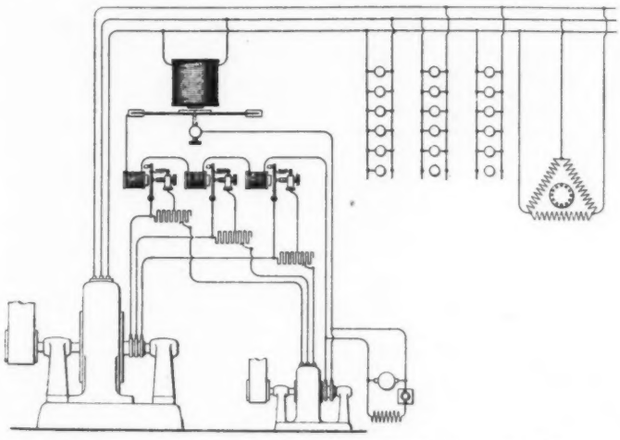
1899-1900—Mr. William Brophy, Boston, Mass.
1900-01—Mr. Morris W. Mead, Pittsburg, Pa.
1901-02—Mr. A. S. Hatch, Detroit, Mich.
1902-03—Mr. W. H. Thompson, Richmond, Va.
1903-04—Mr. A. C. Farrand, Atlantic City, N. J.
1904-05—Mr. Walter M. Petty, Rutherford, N. J.
1905-06—Mr. Jerry Murphy, Cleveland, Ohio.
1906-07—Mr. T. C. O'Hearn, Cambridge, Mass.
1907-08—Mr. R. A. Smith, Norfolk, Va.

Voltage Regulation of "Image Current" Alternators.

A patent issued on June 16 to Dr. C. P. Steinmetz relates to a method for automatically maintaining at a desired value the e.m.f. delivered by a so-called "image-current" alternator. (See our issue for July 14, 1906.)

This type of machine is an alternator whose field member is excited by low-frequency polyphase currents; the e.m.f produced in the generator windings have a frequency corresponding to the difference of the two frequencies due, respectively, to the mechanical rotation in the machine and to the rotation of the magnetic field produced by the low-frequency exciting currents, the machine acting similarly to an induction motor driven above synchronism. When current exists in the armature circuit an equal and opposite current (the "image current") is produced in the field circuit.

The scheme of connection proposed by Dr. Steinmetz is illustrated herewith. The currents in the field circuit traverse the resistors in the exciter circuits and cause thereby a drop in potential, so that the voltage of the exciter circuit near the generator is higher than at the exciter. As the current delivered by the main generator to the distribution system increases in value the current in the exciter circuit from the generator increases correspondingly in value, because of the transformer action of the common revolving field flux which cuts the field and the armature circuit. Therefore, as the load on the main generator increases the voltage supplied to the exciter circuits by the main generator increases likewise, while the voltage supplied to the consumption circuit of the main generator also increases. Now, by varying the resistance of the resistors in the exciter circuits it is evident, assuming the voltage of the exciter to be maintained constant or approximately so, that the voltage of the main generator may thereby be adjusted. This result is accomplished by automatic means responsive to the voltage of that portion of the distribution system at which it is desired to maintain a constant potential. The resistance of the resistors in the exciter circuits is so chosen that when the short-circuits around them are opened there will be an excess of resistance in circuit, and the voltage of the main generator will tend to rise considerably above the desired value of voltage, while when the resistors are short-circuited either in whole or in part the voltage will tend to fall considerably below the desired value. By means of the relay devices illustrated the action of short-circuiting and of inserting the resistors in circuit are repeated at such intervals and with such rapidity that the voltage of the main generator remains sensibly constant at the desired value.



VOLTAGE REGULATION OF "IMAGE CURRENT" ALTERNATORS.

Whitney Metallic Filament.

A patent was issued Aug. 18 to Dr. W. R. Whitney on an incandescent lamp filament formed of nitride of cerium. The specification states that the metal cerium, when at a red heat, has the remarkable property of reacting with pure nitrogen and thereby forming a nitride which has a metallic luster and is a good electrical conductor. In this reaction, the compound being exothermic, an enormous heat is generated, which makes the mass undergoing reaction glow with a brilliancy equal to the arc light. As the elements remain combined in this heat, the nitride of cerium is stable at excessively high temperatures and is with difficulty fusible. From this nitride is formed the incandescing element or illuminant of incandescent or similar lamps by compressing the very finely powdered material mixed with a suitable binder, as paraffin, into rods or filaments. These are then heated to their sintering point by passing through them a higher electric current than they are to carry when in use. It is added that, although the nitride of cerium constitutes the preferable embodiment of the invention, nitrides of other rare earth metals, such as yttrium or lanthanum, may be used. One claim covers a filament formed of a nitride of a rare earth metal.

Electrical Machinery in the Yukon.

The use of eletcrical machinery in the Yukon mining district of the Canadian Northwest has become general. Modern methods and modern machinery have supplanted the old primitive plants, and improvements are being made all over the district. In describing the changes the Canadian *Mining Journal* says: "Scores of extensive large method mining plants have been installed in the Klondike since the region began to emerge from the old conditions of individual operations. The investment in dredges and hydraulic equipment has reached many millions of dollars, and this line of enterprise seems scarcely more than begun. In connection with the dredges extensive outlay has been necessary for steam and water-power plants for generating electricity with which the dredges are driven. For each hydraulic plant long ditch lines are often necessary, causing in many instances great outlay for pipe material for siphons, to say nothing of hydraulic giants and the other parts, aside from lumber for flumes, penstocks and such. The new style of electrically driven elevators or lifts handling tailings from ground being worked hydraulically on the creek bottoms also calls for considerable mechanical equipment. The framework of the lifts are entirely of steel, and carry a steel bucket line, similar to a dredge, and are equipped with two large centrifugal pumps to each lift, for handling water from the sump to the tailing boxes. The hydraulic giants used for washing the gravel down to the lifts are akin to the hydraulic plants used in the operation on hills.

"The electrical equipment for conveying power is one of the largest items of expense. Lines from a quarter of a mile to 60 miles long are installed, already conveying power, and heavy wire and transforming stations add to the quantity of equipment materially.

"In connection with each line is the generating equipment in the form of dynamos driven by turbines or steam plants. Some of the dredges are supplied with power from steam boilers aboard the craft, but the larger concerns have their steam or power plants ashore and electrical lines with which to convey the electricity to the dredges. The several big companies branching out are planning the installment of extensive power plants of the most modern character. The power will be generated from the vast natural water courses and conducted over hills and valleys with copper wire. The many new hill groups organized for working hydraulic plants will demand much more new equipment before long."

CURRENT NEWS AND NOTES.

INDEPENDENT TELEPHONE RECEIVERSHIP.—The Long Distance Telephone Company, of Decatur, Ala., has been placed in the hands of receivers. The bonded debt of the company is estimated at $586,000.

PENNSYLVANIA ELECTRIC ASSOCIATION.—The first meeting of the Pennsylvania Electric Association will be held at Eagles Mere, near Williamsport, Pa., Sept. 8 and 9. Mr. E. S. Smith, of Towanda, is secretary.

COLORADO CONVENTION DATES.—The 1908 convention of the Colorado Electric Light, Power and Railway Association will be held at Glenwood Springs, Col., Sept. 16, 17 and 18. Mr. J. F. Dostal, of the Denver Gas & Electric Company, is secretary.

ELECTRICITY FOR FUJI YAMA.—The beautiful mountain peak of Japan, Fuji Yama, which is so frequently seen pictured on Japanese screens and fans, is to be modernized by electricity. For the benefit of foreign tourists refreshment houses will be built along the trail to the top and also equipped as telephone and telegraph stations. An electric plant will be installed to illuminate the peak at night.

BUFFALO-PITTSBURG ELECTRIC LINE.—Capitalists from Pittsburg, Butler and Franklin, Pa., are back of a project to build an electric line from Buffalo to Pittsburg, surveys for which have already been commenced. The route selected will touch at Conneaut Lake, Mercer and Greenville, with a branch to Franklin and Sharon. From Conneaut Lake to Erie is a continuous line over the roads through Saegerton and Cambridge Springs to Erie and Buffalo.

EXTENDING WESTERN TELEPHONE LINES.—Surveys are now being made for a new trunk telephone line from Wichita to Abeline, Kan., which will connect the Oklahoma system with northern Kansas. The intention is to build a later one to Omaha. One already extends from Abilene to Kansas City with two cables. This will be doubled. The great expansion of the independent service among the farming communities makes trunk lines between the cities necessary for toll line service.

TECHNOLEXICON REVISED.—About a year ago work was suspended on the monumental "Technolexicon" or dictionary in several languages of technical terms, which had for some years been in preparation under the auspices of the several German national engineering societies, and on which a vast sum of money had been expended. All will be glad to learn that the work has now been taken up for completion, the Imperial German and Prussian governments having granted the necessary financial aid.

ELECTRIFICATION OF PACIFIC RAILROADS.—In a recent interview Mr. E. H. Harriman stated that as soon as the money market loosens up three sections of lines of the Harriman system will be electrified. It is his purpose to electrify the mountain division of the Union Pacific road, which runs over the Rockies; the mountain division of the Southern Pacific, which runs over the Sierras, and the new mountain division of the Shasta route, which will run, like the present route, over the Siskiyou Mountains. The estimated cost is said to be $40,000,000.

WILL FIGHT ITS RIVAL'S FRANCHISE.—The Fitchburg (Mass.) Gas & Electric Light Company has filed with the Gas and Electric Light Commission of Massachusetts a protest against the action of the aldermen of Fitchburg in granting the Connecticut River Transmission Company the right to erect poles and string wires for the purpose of bringing current into that city. The Connecticut River Transmission Company is said to be allied with the French King Rapids Power Company, which was given the right to use the water power of the Connecticut River at the last session of the Legislature, and a franchise to sell electricity in Fitchburg and practically all parts of Worcester County.

SINGLE-PHASE INDUCTION MOTOR FOR TWO VOLTAGES.—A patent issued Aug. 18 to Mr. F. R. Kunkel covers a scheme for so winding a single-phase induction motor that it may be used for two voltages, one equal to twice the other. The main winding is divided into two sections that are arranged in series relation for the higher voltage and in parallel for the lower voltage. The novelty of the scheme resides in connecting the auxiliary (split-phase) winding in parallel with only one of the sections when the two are joined in series, so that substantially the same voltage is applied to the starting circuit regardless of whether the motor is connected to a high-voltage or a low-voltage circuit, providing, of course, that the high voltage is double the low voltage.

EDISON ILLUMINATING CONVENTION.—President Alex Dow announces the preliminary details of the program of the annual meeting of the Association of Edison Illuminating Companies, to be held at the Hotel Aspinwall, Lenox, Mass., Sept. 15 to 17. Papers will be presented for discussion on the following subjects: Methods of handling accidents to employees; the status of the special customer; a study of residence lighting; methods for preventing the destruction of generators in case of short circuit; measurements with portable testing instruments; modern substation for Edison illuminating companies; some advertising notes with particular reference to the advertising value of the display room; recent automatic stoker practice; contracts for sale or purchase of large blocks of power; present European lighting methods; the question of a standard policy as to metallic filament lamps. Dr. C. P. Steinmetz will deliver a lecture on "Electrical Engineering Problems of the Future."

FRENCH WIRELESS TELEPHONE.—According to a press dispatch, three French naval officers, Lieuts. Colin, Jeance and Mercier, have obtained excellent results with a wireless telephone of their invention. In a recent trial communication was successfully maintained between Paris and a wireless station at Raz de Seine, Department of Finistère, a distance of about 310 miles. It is stated that the transmitted words were somewhat faint, but could be plainly distinguished, and the officers are confident that they can make great improvements in the apparatus, which has been the result of only four months' experimentation, enabling the exchange of conversation up to 600 or 700 miles. Lieut. Colin, the chief inventor, is a well-known wireless expert, having installed the wireless station in the Eiffel Tower, which is one of the most efficient in the world. He is now superintending the installation of an improved and more powerful plant, in order to make possible the transmission of dispatches between Paris and New York.

TITLES OF U. S. PATENTS.—That the title of a U. S. patent may have little or no relation to the invention covered is well known. For example, a favorite title is "Electromagnetic apparatus," which may conceal anything from a dynamo to a medical belt. This fault is the more serious from the refusal of the Patent Office to follow the custom of the European countries, which print on the patent specification and in the periodical list of patents granted the classification data, thereby in effect requiring inventors and others to have recourse to a patent attorney in case they desire to follow closely through patent specifications a certain line of invention. A patent issued last week furnishes an illustration of the need of some revision of Patent Office practice with relation to assigning titles to inventions. The remarkable title of the patent is "Composition of matter and the manner of making the same," while the specification and claims relate merely to the impregnation of clay or similar non-conducting substance with a metallic element, in order to make the resultant somewhat conductive.

Electrical Generating System of the Newton Gas & Electric Company of Newton, N. J.

THE town of Newton, N. J., has a population of about 5000. It is situated on the Sussex Division of the Delaware, Lackawanna & Western Railroad, and is within commuting distance of New York City. A number of small but thriving industries are located in Newton and it possesses both a gas and an electric service. The electric and gas systems are owned by the Newton Gas & Electric Company. The town has no electric service during the day and the maximum load at night does not exceed 250 kw. The station, however, is an interesting one, because the prime movers are producer-gas engines, which are belted to three-phase alternators. There are about 250 customers connected with the company's lines and although the load is chiefly residence lighting, the net earnings are about $6,500. The cost of generating electricity is 1⅛ cents per kw-hour at the switchboard, and the maintenance cost is 0.0026 cent per kw-hour delivered. The initial cost of the station and equipment was $33,000.

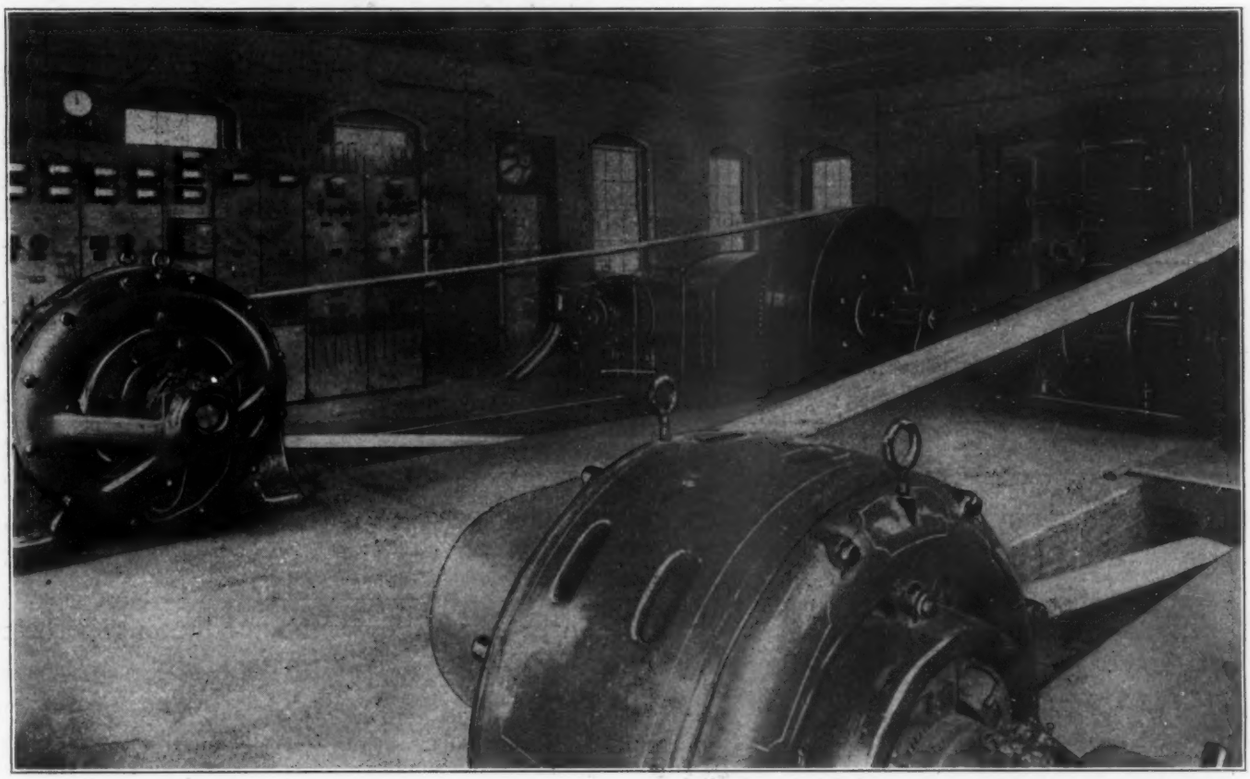


FIG. 1.—GENERAL VIEW OF GAS-ENGINE-DRIVEN GENERATING UNITS AND SWITCHBOARD.

The power house is situated on the outskirts of the town immediately adjoining the gas works. This arrangement not only serves to concentrate the company's properties, but in case of mishap to the producer-gas equipment makes illuminating gas available for use in the gas engines. The equipment comprises one 100-hp and one 200-hp producers, both of which are capable of furnishing a gas having a calorific value of 135 b.t.u. per cubic foot. The engines, which are rated the same as the producers, require approximately 82 cu. ft. of gas per brake hp-hour, producer gas, of course, having a much lower calorific value than illuminating gas.

The engines are belted to a 75-kw and a 150-kw, 2300-volt, 60-cycle, three-phase generator; the electrical output is controlled by a 10-panel switchboard of standard design. The enclosed-arc lamps used for public lighting are fed with energy from two 50-lamp, constant-current transformers. There are approximately 8½ miles of electric circuits in the town. Secondary 2 × 110-volt circuits are used for local distribution from pole-line transformers. The three-phase circuit is split into three individual circuits. Two of the single-phase circuits are used for the tub transformers and the remaining circuit carries the incandescent-lighting load. The phases being out of balance on peak load, a Tirrill regulator is used to regulate for fluctuations in voltage on the phase feeding the incandescent-lighting circuits. The public lighting load comprises 90 series enclosed, 6.6-amp arc lamps and 18 series incandescent lamps fed with energy from the same series circuits.

The gas engines are of the American Crossley type built by the Power & Mining Machinery Company, and the producers are of the Crossley suction type, using anthracite peal coal costing $3.50 a ton delivered at Newton. The hoppers hold 75 lb. of coal and at regular intervals of 2½ hours the producers are charged with as many hopperfuls as are required to fill them. The producers are fitted with shaking grates for breaking up and forcing through the clinker, so that the fuel bed is easily kept clean. At the end of the night's run the ashes are removed.

Above the fuel bed is a saturator, communicating with the interior of which are four air valves. The latter serve to admit air which mingles with the steam generated in the saturator and passes down through suitable pipes to an air box which surrounds the producer just above the level of the grate. The air box is arranged so that the air as it comes down is discharged at the opposite side of the box, through which it is required to pass half-way round. The air as it emerges mingles with a supply of fresh air admitted through a primary air pipe and passes up through the bed of incandescent fuel to the scrubbers. On its way through the bed of fuel the air takes up carbon and is converted into a combustible gas before it reaches the scrubber.

The first, or wet scrubber, consists of a cylinder filled with coke, over which water trickles. The gas from the producer is caused to pass downward through this scrubber and up through a similar arrangement on top of which is a dry scrubber; the filling for the latter consists of excelsior, sawdust or shavings. After passing through this scrubber the gas goes to the engine. The circuit of air through the fire and scrubbers is caused by the suction of the engine; a vacuum of 6 in. on the water gage

is produced by this means in the pipe leaving the dry scrubber.

A purge pipe is provided for permitting the gases to escape when the fire is started in the producer. A fan in the primary fresh-air supply line is used in kindling the fire quickly. If insufficient steam is present in the air from the saturator, the gas will not be rich enough in hydrogen and clinker will result; while, on the other hand, the pressure of too much vapor will give a gas too rich in hydrogen and the fire will suffer from the excess of moisture. It is possible to regulate the amount of steam generated in the saturator by governing the amount of water circulating over it.

The larger gas engine is fitted with two cylinders opposed on a single crank. The smaller engine has a single cylinder. A Kites governor is employed to regulate the speed. Secondary cam shafts are fitted to the side of the engine. These are driven through spiral gears from the main shaft. The gas and air valves are operated from the secondary shaft through cams and rocker arms. A grid-iron valve controlled by the governor cuts off the supply of explosive gas from the main admission valve at all loads above one-third full load. The main valve is of the mushroom type and opens and closes so as to give maximum admission at all times. At all loads below one-third full load the governor regulates on the hit-and-miss principle. The exhaust valve is water cooled.

A magneto driven directly from the end of the cam shaft is used to furnish the electrical energy for ignition purposes. Lubrication is effected by a force-feed lubricator driven from the cam shaft.

The lamps used in the 250 residences connected to the company's circuits are rated chiefly at 16 cp and 8 cp. These are renewed free of charge. Tungsten lamps rated at 100 watts are

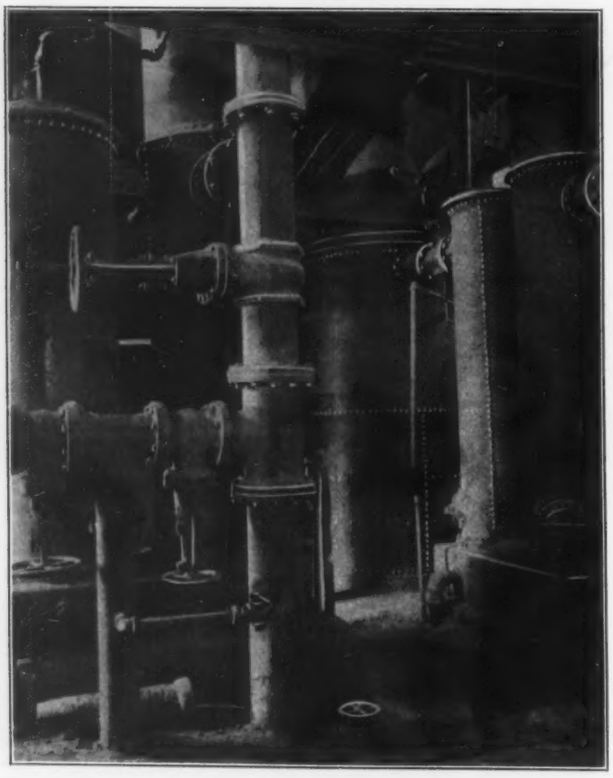


FIG. 2.—VIEW OF GAS PRODUCERS.

sold at the rate of $1.75 each, and the customer pays for renewals. There are also a number of Nernst lamps connected to the circuits. All customers receive their supply of energy through meters. The rates for residence service range from 15 cents to 8 cents per kw-hour, depending on the quantity used. Stores requiring over 100 kw-hours are lighted at 8 cents per kw-hour, and the bill is subject to a discount of 5 per cent for prompt payment. Illuminating gas sells at $1.60 per 1000 cu. ft. for straight lighting; $1.45 for combination service, and $1.20 for fuel service. In many of the residences use is made of gas for cooking and electricity for lighting. Although there are about 700 gas customers to 250 electricity consumers the incomes from the two are about equal.

No solicitors are employed to search for business, but advertisements are carried in all the papers and dodgers are distributed from time to time announcing the appearance of some new device, etc. The company does a wiring business and the

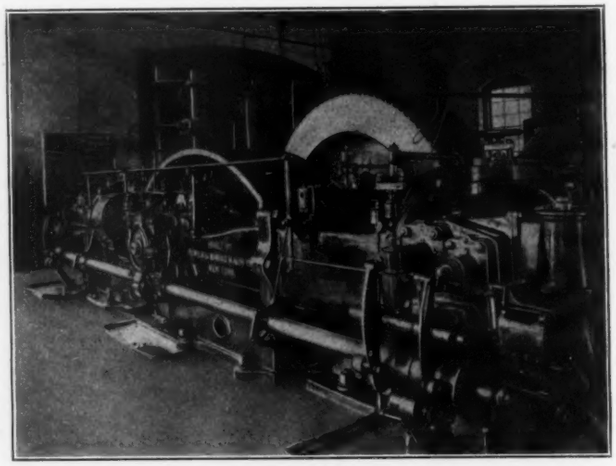


FIG. 3.—NEAR VIEW OF GAS ENGINE.

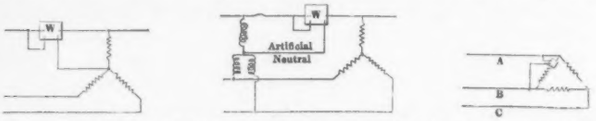
installations are made at cost of material. Ninety per cent of the wiring is knob-and-tube work, while the remaining 10 per cent is conduit work. The wiring is done in accordance with Code requirements; the average cost per outlet on knob-and-tube work is $1.80. All distribution wires being overhead, the service entrances are also overhead. An emergency motor service is installed in the local silk mills, the load aggregating 50 hp. This service, of course, is available only at night, but advantage has frequently been taken of the emergency connection by the mill owners for night work. The summer load on the station averages 190 kw. The electric lighting lines do not extend beyond the town limits.

Three-Phase Power Factor by Single-Phase Wattmeter.

By Nicholas Stahl.

In a balanced three-phase circuit, the total power delivered may be measured by a single wattmeter for either star- or delta-connected loads, the total power being equal to three times the wattmeter reading. In the former case the current coil of the instrument is connected in one of the mains, and the voltage coil across that main and the neutral point of the load as shown in Fig. 1.

In star-connected motors, whose circuits are approximately balanced, it was at one time frequently the custom to bring out a lead from the neutral point, in order to make this voltage coil



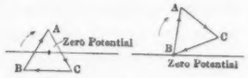
FIGS. 1, 2 AND 3.—SINGLE WATTMETER IN STAR AND DELTA CIRCUITS.

connection. This is, however, unnecessary, as an artificial neutral point may be obtained by connecting three equal non-inductive resistances across the phases, as in Fig. 2, which arrangement effects a considerable saving in time and expense in the manufacture of a large number of machines. Such an arrangement can be easily effected by the use of three strings of incandescent lamps, for example.

For delta-connected circuits, the connection of the current coil

is in a mesh, inside the junction point, and the voltage coil is placed across the corresponding mains, as in Fig. 3. If E denote the effective voltage between mains, and I the current in any main, then for the star-connection the voltage coil will have across its terminals an effective voltage of $\frac{E}{\sqrt{3}}$ and the power recorded by the instrument will be $W_1 = \frac{EI}{\sqrt{3}} \cos \Theta$, where Θ is the angle of lag in the circuit. For the delta case, however, the current in a mesh is $\frac{I}{\sqrt{3}}$, while the voltage across it is E; hence, again, $W_1 = \frac{EI}{\sqrt{3}} \cos \Theta$, and the whole power for either case is $W = 3 W_1 = \sqrt{3} EI \cos \Theta$.

But for unbalanced circuits—the general case to be provided for—it is quite different, and for simplicity and economy,

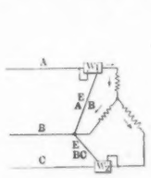


FIGS. 4 AND 5.—VOLTAGE TRIANGLES FOR NORMAL AND GROUNDED-MAIN CIRCUITS.

it is usual to employ two wattmeters instead of the obvious three-instrument method. That two single-phase wattmeters or a polyphase wattmeter properly connected will suffice to record the power absorbed in a three-phase circuit, whether star or delta connected, is a matter of such general knowledge that an analytical proof of the theorem is here unnecessary.

It can readily be seen, without the aid of mathematics, that this must be so, if it is considered that the sum of the currents flowing past any section of a three-phase circuit is equal to zero, and, therefore, any single conductor may be regarded as a return main for the outgoing currents in the other two. And, so far as the voltage is concerned, the return main might be looked upon as grounded, in which case the voltage triangle instead of revolving around its center of gravity, considered as the point of zero potential, as in Fig. 4, would revolve about the grounded terminal, as in Fig. 5.

It might be noted in passing that this condition, which not infrequently actually occurs in practice, subjects the insulation of the apparatus so affected to dangerously high strains, rendering break-downs correspondingly liable upon the occurrence



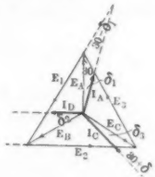


FIG. 6.—TWO WATTMETERS IN STAR CIRCUITS. FIG. 7.—VOLTAGE AND CURRENT RELATIONS IN BALANCED STAR CIRCUITS.

of abnormal voltages in the system, particularly in the case of resonance or "surges." And if such a system of connection were used, additional lightning protective apparatus would be rendered necessary.

It is, however, important to note that the voltage coils of the two meters are connected from the respective mains of their current coils to the same third main. It can also be shown that when a current coil of one instrument and a voltage coil of the other are connected to the same main, the total power registered will be in excess of the power actually delivered.

If we wish to obtain an expression for the values of the separate wattmeter readings in terms of the actual effective voltages between mains and currents in them, we may make use of a vector diagram, like Fig. 7, in which, for star-connected circuits, the lettering corresponds with the notation in Fig. 6.

The power recorded by each instrument is, of course, equal to the product of the current in its series coil by the voltage across its shunt coil times the cosine of its lag angle, or power factor.

In the general case, where the voltage and current triangles have suffered pronounced distortion, the solution of the problem of determining from the wattmeter readings alone the values of the separate lag angles in the individual branches, though perfectly definite, becomes tedious and quite impractical, both from the number (nine) of separate readings which would have to be taken and also from the subsequently necessary algebraic reduction.

Such a case occurs, for example, where a three-phase system supplies a railway with single-phase power, without correction against distortion, produced not alone by load unbalance, but by changes in the impedance drop in the generator circuits. If, however, we may assume, as will generally be the case, that the voltage triangle remains practically equilateral, the above expressions will be generally true, even though the currents are not equal. This means that the angles between the branch e.m.fs. and those across adjacent mains are each equal to 30 deg.

Then, it is easily shown that $W_1 = E_1 I_a \left(\frac{\sqrt{3}}{2} \cos \Theta + \frac{\sin \Theta}{2}\right)$ and $W_2 = E_2 I_c \left(\frac{\sqrt{3}}{2} \cos \Theta - \frac{\sin \Theta}{2}\right)$

Should the ratio of the reactance to the resistance be constant for the separate phases, then the lag-angles are all equal and $W_1 + W_2 = \frac{\sqrt{3} E_1}{2} (I_a + I_c) \cos \Theta$, and if, finally, the circuit be balanced

$$W_1 + W_2 = \sqrt{3} E I \cos \Theta, \text{ as before.}$$

In order to determine the percentage power factor for which the two instruments will have equal readings, we have only to

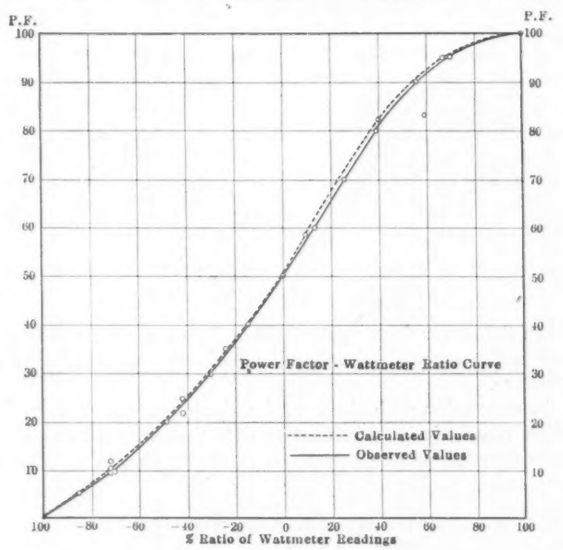


FIG. 8.—VARIATION OF WATTMETER READINGS RATIO WITH POWER FACTOR.

equate their values and solve for Θ (on the assumption, now, of a balanced circuit). This gives $\Theta = 0$, or power factor = 100 per cent. Since the coefficient of $E_1 I_a$ is the sum of a sine and cosine term, W_1 can never become less than zero; that is, never reverse its reading, while for W_2 it is evident that there is some value of Θ for which its two terms—of unlike sign—will become equal, which will make $W_2 = 0$, which gives $\Theta = 60$ deg. and cos Θ, or power factor = 50 per cent. An inspection of the coefficients shows also that when $\Theta = 90$ deg. or power factor = 0 per cent, the two instruments will have equal but opposite readings.

In the case of a delta-connected mesh, we arrive at precisely the same expresions for the wattmeter readings by a similar triangle construction.

It is frequently the practice, especially in large manufacturing establishments, where many machines are under test, to plot the ratio of the two wattmeter readings against the percentage power factor for the purpose of gaining a check upon the latter as otherwise independently determined, as, for instance, by

the *ratio* of watts to volt-amperes, or to read off the power factor at once in the case of similar machines.

Such a curve is shown in Fig. 8 plotted upon the assumptions above, and also a similar curve from the actual wattmeter reading ratios plotted against the power factors obtained for the several points from watts-to-volt-amperes ratios in the case of a 5-kw, three-phase, 200-volt, type CCL Westinghouse induction motor.

The close agreement between the calculated and observed values shows a striking verification of the validity of the assumptions. It was at first supposed that this curve would form a straight line, and the deviation from it, found from the results of test, was attributed to errors of observation. That such is not the case is seen from the above different expressions for the two readings, which show that the decrease in one, with change of power factor, is not compensated for by a *proportional* increase of the other.

Moreover, it should be borne in mind that the only physical assumption made in connection with the theoretical derivation of the curve was that the circuit should be balanced. And a motor, for example, not fulfilling this condition, at least approximately, would evidence poor engineering, involving unequal and, therefore, unnecessary heating in its various windings.

This curve, therefore, will serve as a power factor meter, *exact* within the limits of curve reading for *balanced* circuits and *approximate* for only slightly unbalanced ones. It is merely necessary to take the ratio of the readings of the two instruments, run out to the curve, and locate the corresponding power factor, care being taken to make the smaller reading the numerator of the fraction.

It should also be noted that the curve, as well as common observation, shows that the reading of one instrument reverses

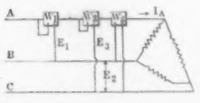


FIG. 9.—VARIOUS WATTMETER CONNECTIONS IN DELTA CIRCUIT.

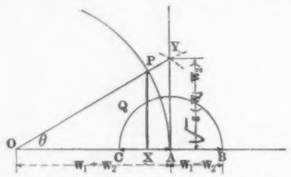


FIG. 10.—POWER FACTOR READING.

when the power factor passes through 50 per cent, which necessitates the reversal of connections of one of its coils at that juncture.

In connection with the use of a single wattmeter in a three-phase circuit, it is of interest to note that the voltage coil may have three different connections, as shown in Fig. 9. The corresponding readings are:

$$W_1 = E_1 I_a \left(\frac{\sqrt{3}}{2}\cos\theta + \frac{\sin\theta}{2}\right)$$

$$W_2 = E_2 I_a \left(\frac{\sqrt{3}}{2}\frac{\cos\theta}{2} - \frac{\sin\theta}{2}\right)$$

as before, and

$$W_3 = E_3 I_a \sin\theta. \quad \text{(See also Fig. 7.)}$$

For this last case it is evident that when the load is non-inductive W_3 becomes equal to zero. This result may also be verified to curves drawn for the sine wave of e.m.f. and current in a balanced three-phase system, which show that when the current in main A is at a maximum the e.m.f. between B and C will be zero, and vice versa, and for other times the directions of current in A and e.m.f. between B and C will be so directed that for half a cycle the instrument will tend to read in one direction and for the other half cycle in the opposite direction, and, therefore, its resultant reading will be zero.

It is also clear that the maximum reading will be obtained when the power factor is zero, when sin θ becomes a maximum. Since E_3, being the effective e.m.f. generated in one leg of the generator (less line drop), will be practically constant, or may be held so by a Tirrill regulator, for example, and since an inductor motor using a large number of resistance steps for starting, the current may be roughly regarded as constant, we can use this method of wattmeter connection on three-phase circuits as a *phase-meter* or *power-factor meter*, remembering that as the reading decreases the power factor increases.

This is, of course, a "rough and ready" method for use where power-factor meters are lacking, and where the otherwise necessary voltmeters and ammeters are not at hand or inconvenient. To use the ordinary trigonometrical relation between sine and cosine to get a more accurate result would be useless, as variations in voltage and current would introduce errors far offsetting any such refinement. But where two wattmeters are being used in a three-phase circuit, as in Fig. 6, another more accurate and simpler method of finding the power factor is by the use of the readings of both instruments as follows:

From a consideration of the above general equations for the two instruments it is easily shown that:

$$\tan\theta = \sqrt{3}\left(\frac{W_1 - W_2}{W_1 + W_2}\right)$$

From the value of the lag-angle tangent so found can be *calculated* very easily the corresponding value of the power factor.

However, the following graphical construction enables the power factor to be read off at once in per cent with an accuracy dependent only upon the size of scale used and the total errors in instrument readings.

As in Fig. 10, draw on co-ordinate paper the value of $W_1 + W_2$ to cover (say) a decimal number of divisions. Call this OA, and draw with center O, arc AP. With center A and radius, to same scale, equal to $(W_1 - W_2)$ draw semicircle CQB. With C and B as centers and radii equal to $CB = 2AB$, draw arcs intersecting at Y. Then will $AY = \sqrt{3}(W_1 - W_2)$. Join OY and drop PX perpendicularly to OA.

$$\text{Now, } \tan\theta = \frac{AY}{OA} = \sqrt{3}\left(\frac{W_1 - W_2}{W_1 + W_2}\right)$$

Then power factor $= \cos\theta = \frac{OX}{OA}$, and since OA is a decimal number of divisions OX can be read from it in per cent at once.

This method has the advantage of freedom from any arbitrary assumptions in regard to constancy of e.m.f. and current, holding good for any balanced circuit, and with only a small percentage of error, even in the case of badly unbalanced circuits.

We, therefore, find three methods by which a single-phase wattmeter may be made to give power factor readings of a three-phase circuit: first, the "rough and ready" method shown by wattmeter in position W_3 in Fig. 9, from the equation $\sin\theta = \frac{W_3}{EI}$; and, second and third, the graphical methods indicated in Figs. 8 and 10.

It is believed that the latter two, with their freedom from unwarranted restricting assumption, will prove of use in checking the power factor by other methods, or in determining it *ab initio*.

The Synchronous Motor in Systems Operating at Low Power Factor—II.

By F. C. Helms.

In a previous issue the evil effects of low power-factors were discussed briefly with a more complete discussion of the inherent characteristics of the synchronous motor which enable it to take a current which may lag behind or lead the impressed e.m.f.

In the present issue there will be discussed the most economical power-factor at which to operate synchronous motors which are to be used for improving the power-factor of the system as well as for delivering mechanical power, the advisability of installing rotary condensers of sufficient rating for increasing the power-factor of systems from a low value up to unity, and the rating of rotary condensers required for actual service.

If synchronous motors are to be installed for driving machinery and for simultaneously improving the power factor of the

generator and transmission line feeding energy to an inductive load, the most effective way of using them will be to load them to 70.7 per cent of their rated output and then to increase the field current until normal rated current exists in the armature. The motor will then be operated at a power factor of approximately 70.7 per cent and will have a wattless component of leading current equal to 70.7 per cent of its rated full-load current. At this particular point 70.7 per cent of the normal rated current output does effective mechanical work and 70.7 per cent leading current is available for improving the power factor of the system.

The curves in Fig. 6 show the variation with the change in power factor of the power and wattless components, A and

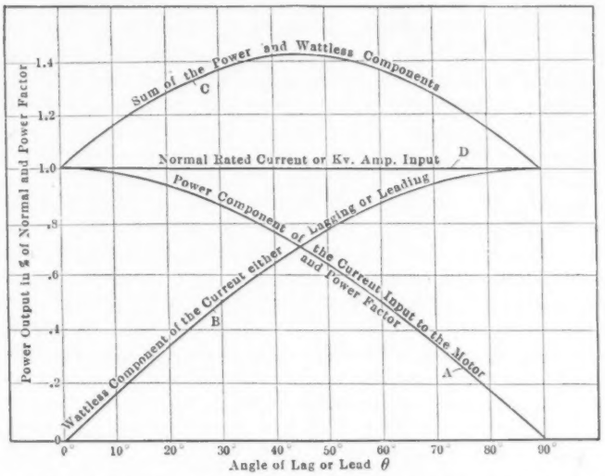
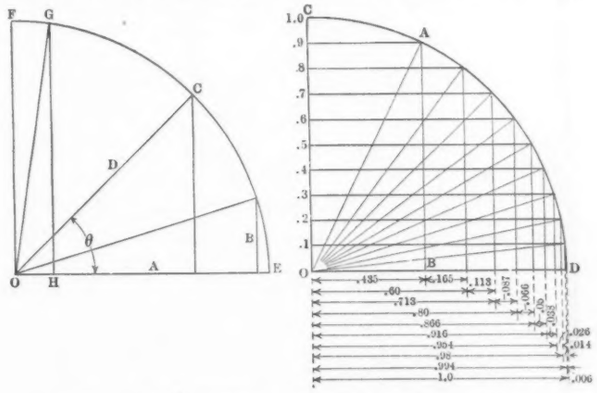


FIG. 6.—VARIATION OF THE POWER AND WATTLESS COMPONENTS OF CURRENT, WITH CHANGE IN POWER FACTOR.

B, and their sum C, the input current D remaining constant. The horizontal straight line D drawn through 1.00 on the vertical scale, labeled "power output," represents the normal rated full-load current and also the kv-amp rating (since they are proportional depending only upon the voltage, which is constant) of the motor.

The value of D is represented graphically by the radius of the circle in Fig. 7, which is the hypothenuse of a right-angled triangle whose legs are the varying components A and B. It is evident that $D^2 = A^2 + B^2$ and it can be easily shown that the sum of $A + B$ will be the greatest possible when $A = B$. Curve



FIGS. 7 AND 8.—EFFECTS OF POWER FACTOR CHANGES.

A is in reality a cosine curve and represents the power component of the current input or the mechanical output in per cent of the rating of the motor. Curve B is a sine curve and represents the wattless component of the current input to the motor.

The ordinates of curve C are equal to the sum of the ordinates of curves A and B, hence this curve gives the sum total of the component of current available for doing mechanical work and that available for neutralizing lagging current with a constant current input at the motor terminals.

If the motor is used simply as a "condenser" running idle on the line, it will take a wattless current either leading or lagging depending upon the excitation of the field. If the field is over-excited sufficiently to produce a full-load value of current in the armature, this current will lead the impressed e.m.f. by nearly 90 time-degrees, or the motor will take a wattless leading current at a power factor equivalent to zero. This condition is represented by D, assuming the position OG, in Fig. 7, OH representing the small power component of current required for overcoming the losses in the machine. When operating under these conditions there can be obtained a value of C only slightly greater than D, since A is very small, being only equal to OH. It is evident that this is not the most effective point of operation.

Consider now the increase in the power component of the current in the generator and line up to the terminals of the rotary condenser—the total current in this part of the circuit remaining constant—due to the neutralizing by leading current of a part or all of the lagging current, required by inductive apparatus beyond the terminals of the condenser.

In Fig. 8 let the radius OA of the circle be the normal total current which the generator and transmission line can carry, which is to be assumed constant for the purposes of this investigation. The vertical lines, such as AB, represent the wattless or unneutralized lagging components which combined with the power components, such as OB, produce the total constant line current OA. This diagram shows that the introduction of leading current for improving the power factor is a great deal more effective at low power factors than it is when the power factor is high.

If with the generator and line delivering a wattless lagging

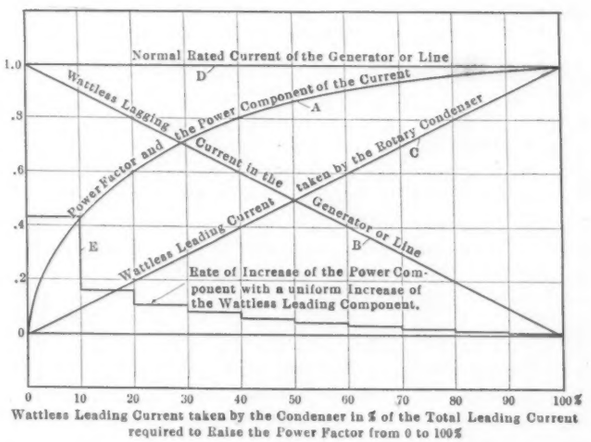

Normal Rated Current of the Generator or Line
D
Wattless Lagging
the Power Component of the Current
A
Power Factor and
Current in the
taken by the Rotary Condenser
C
Generator or Line
Wattless Leading Current
E
B
Rate of Increase of the Power Component with a uniform Increase of the Wattless Leading Component.
1.0
.8
.6
.4
.2
0
0 10 20 30 40 50 60 70 80 90 100%
Wattless Leading Current taken by the Condenser in % of the Total Leading Current required to Raise the Power Factor from 0 to 100%

FIG. 9.—EFFECTS OF CHANGE IN WATTLESS CURRENT TAKEN BY ROTARY CONDENSER.

current at zero power factor equal to their normal full-load rating, represented by the vertical line OC, a leading current equal to OC is introduced and the load on the external circuit is adjusted so as to keep the generator and line current constant and equal to OA, the generator will deliver the current OD at 100 per cent power factor, or it will be delivering its full rated output in actual power. It should be noted that the current in the external circuit will have increased from OC at zero power factor to 1.414 OC at 70.7 per cent power factor.

Suppose now the leading current is introduced in 10 equal installments each equal to 10 per cent of the total leading current OC, which would raise the power factor from zero to 100 per cent. The figures 0.435, 0.60, 0.713, 0.80, 0.866, 0.916, 0.954, 0.98, 0.994 and 1.0 at the bottom of the diagram show the power component of current, or power factor, which results from the introduction of the 10 installments. The figures 0.435, 0.165, 0.113, 0.087, 0.066, 0.05, 0.038, 0.026, 0.014 and 0.006 represent the increase in the power component or power factor for each 10 per cent increase in current above the value it had before the increase was made.

The above results are shown by the curves in Fig. 9, in

which the horizontal straight line D represents the normal rated current output of the generator or line, which is kept constant for all the varying values which the wattless lagging and power components may assume. It should be noted that the lagging current in the external circuit is supposed to remain constant at the value OC, which is equal to the normal generator and line current, hence, as the lagging current in the generator and line is neutralized an equal amount of power current is added to both the external circuit and to the generator and line in order to keep the current OA or D in the latter constant. Hence it is evident that when all the lagging current

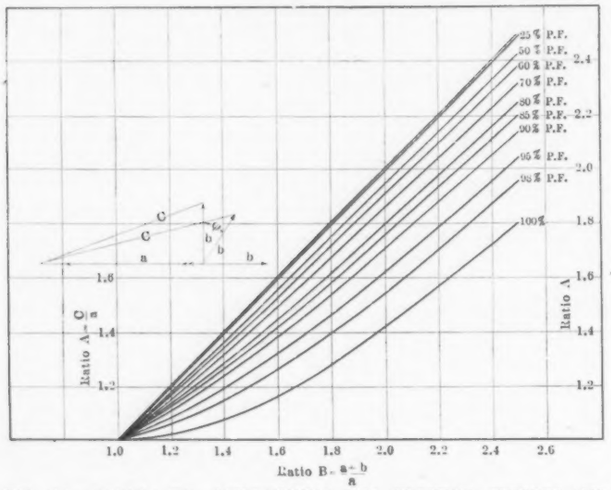


FIG. 10.—CURVES FOR DETERMINING THE EXCITING CURRENT FOR LOADS OF DIFFERENT POWER FACTORS.

in the generator and line has been neutralized the power component in both circuits has been increased by an amount equal to $OD = OA = OC$, or the generator power output has been increased from OA at zero power factor up to OA at 100 per cent, while the kv-amp delivered to the external circuit has been increased from OA at zero power factor to $1.41 \times OA$ at 70.7 per cent power factor. The curve A represents the power factor or the power component of the current made available by the existence of leading current represented by C.

It is evident from Fig. 9 that an increase in the power factor beyond 90 per cent is obtained only at the expense of a large increase in the size of the condenser supplying the leading current. To gain the last 10 per cent increase in power factor and power component of the current the rating of the condenser must be increased 74 per cent above the rating required to raise the power factor from zero to 90 per cent.

From the standpoint of increasing the output or power component of the current it does not pay to increase the power factor beyond 90 per cent, but from the standpoint of current required for the field coils of the generators and the voltage regulation it may be desirable to increase it still higher, because the demagnetizing effect of lagging armature currents is pronounced for a change in power factor from 100 to 90 per cent.

The rate of increase in the field current required by a generator delivering current at various power factors is shown by the curves of Fig. 10, where a is the exciting current, b is the synchronous impedance or armature reaction ampere turns, and Θ is the angle of lag in a generator or lead in a motor.

Let a the field ampere-turns necessary to generate normal voltage $+IR$ drop on open circuit be represented by 1.0. Also let the current delivered by the generator be constant at whatever power factor exists, then c the synchronous* impedance ampere-turns will be constant and it may be assumed that c is equal to 40 per cent of a; then the ratio B will be 1.4, and from the curve for 100 per cent power factor the ratio $C \div a$ is found to be 1.075, or $C = 1.075\,a$ is the field current required for full-load current at 100 per cent power factor. Now, with the same value of B $C = 1.185$ for 95, $C = 1.233$ for 90, and $C = 1.28$ for 80 per cent power factor. Comparing the values of C obtained for 95, 90 and 80 per cent power factors with that obtained for 100 per cent power factor, the value of C of 1.075 at 100 per cent power factor may be taken as the basis from which to work. C at 95 per cent power factor is 10 per cent, at 90 per cent power factor is 15 per cent and at 80 per cent power factor is 19 per cent greater than at 100 per cent power factor. Hence for a decrease of power factor from 100 to 90 per cent the field excitation must be increased by 15 per cent, while an equal decrease in power factor from 90 to 80 per cent the field excitation must be increased by only 3.5 per cent above that required at 90 per cent power factor.

The above comparisons are not strictly correct since the value of a to be used when the machine is carrying current at a low power factor will be appreciably larger than the value obtained from the saturation curve for the voltage equal to the terminal voltage plus the IR drop in the armature. However, for the analysis made here the results show the approximate comparative values which will exist for various power factors.

From the above it is seen that while the improvement of the power factor from 90 to 100 per cent is hardly advisable from the standpoint of the increase in the power component of the current, it is desirable from the standpoint of field excitation and regulation of generating apparatus. The curves in Fig. 11 are plotted from Fig. 10 to show the variation of the excitation or field current with power factor for generators having various values of reactance or synchronous impedance. In interpreting these curves it should be remembered that the armature current has the same value in all cases. The machines having large values of reactance have poor regulation and their field current is greatly increased with consequent increased heating when the power factor is low.

In plotting these curves the field current or excitation a necessary for generating normal voltage plus the IR drop is used as a basis and made equal to 1.0.

The curves show the rapid increase in the field current for the first 10 or 15 per cent decrease in power factor and the

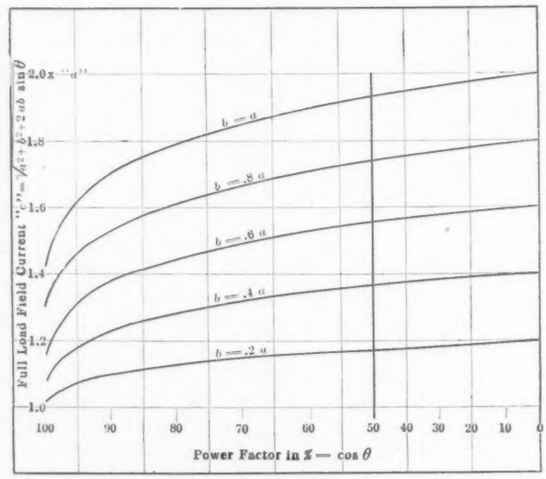


FIG. 11.—VARIATION OF THE EXCITATION CURRENT, WITH THE POWER FACTOR FOR DIFFERENT VALUES OF REACTANCE.

gradual increase as the power factor decreases beyond these values.

RATING OF SYNCHRONOUS CONDENSERS.

Fig. 12 is a simple diagram showing the relations which exist between the various factors of an alternating-current system feeding energy to inductive apparatus. The base, $OC = c$, represents the actual power in kilowatts to be supplied to the substation or feeder system by the generating apparatus over the transmission line. The leg, $CK = a$, represents the lagging or wattless kv-amp required by inductive apparatus receiving energy from the feeder system. $BK = M$ and represents the lagging kv-amp which is neutralized by an equal amount of leading kv-amp, KB, taken by the synchronous condenser.

*It is to be noted that c is the ampere-turns of field excitation necessary to cause the current c to flow through the armature, the armature being short circuited on itself.

Hence, M represents the rating of the synchronous condenser necessary for raising the power factor of the generating apparatus and transmission line, up to the terminals of the synchron-

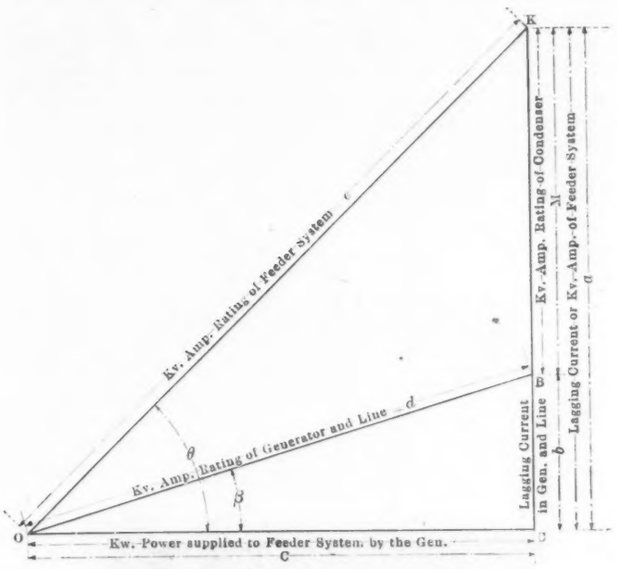


FIG. 12.—RELATIONS EXISTING BETWEEN THE VARIOUS FACTORS OF AN ALTERNATING SYSTEM FEEDING ENERGY TO INDUCTIVE APPARATUS.

ous condenser, from cos Θ, that existing on the feeder system, beyond the terminals of the synchronous condenser, to cos β that which exists in the generator and transmission line, up to the terminals of the synchronous condenser. CB represents the unneutralized lagging kv-amp in the generator and transmission line up to the terminals of the synchronous condenser. $OK = e$ represents the apparent power or kv-amp being supplied to the feeder system at power factor cos Θ. $OB = d$ represents the apparent power of kv-amp being generated and transmitted over the transmission line at power factor cos β.

From the geometrical relations represented by the various lines and angles in Fig. 12 it may be shown that $M = d \cos \beta \tan \Theta - d \sin \beta$.

The diagram of Fig. 13 was designed for finding the value of M as expressed in the above equation. This diagram will be explained in connection with two practical cases a little later. To illustrate, suppose that a feeder system requires 1450 kw at 50 per cent power factor (2900 kv-amp). A synchronous motor capable of taking 2000 kv-amp leading current at practically zero power factor may be installed for increasing the power factor of the generator and line. It is required to find the kv-amp rating d in Fig. 12 and the power factor cos β of the generator necessary to supply the 1450 kw of power required by the feeder system. In this case we have given

$$e = 2900 \text{ kv-amp} \cos \Theta = 0.5; \quad \Theta = 60 \text{ deg.}$$
$$c = 1450 \text{ kw.}$$
$$M = 2000 \text{ kv-amp.}$$

From the above the following values:

$$a = 2900 \times \sin \Theta = 2510 \text{ kv-amp.}$$
$$b = 2510 - 2000 = 510 \text{ kv-amp.}$$
$$\tan \beta = 510 \div 1450 = 0.352 \quad \beta = 20 \text{ deg.}$$

Cos β or power factor of generator and line = 0.94 or 94 per cent.

$d = 1450 \div 0.94 = 1545$ kv-amp the rating of the generator and line.

In Fig. 13 the radial lines, such as OA, OD, etc., whose lengths are constant and equal to the radius of the circle $O—ADBF$ represent the maximum current of kv-amp of the generating station and transmission line at any power factor from 50 to 100 per cent. The projections OG, OE, OC, etc., of the radial line OA in the various positions corresponding to the power factor for which they are labeled, represent the actual power load supplied to the feeder system by the generating apparatus over the transmission line. The radial lines OB, OD, etc., are drawn with the angle β of such a value that the distances, such as OC, shall be equal to the cosine of β, while the vertical lines, such as CB, are equal to sin β.

It is, therefore, evident from Fig. 13 that the radial lines, such as OH, OI, etc., terminating in the vertical line FH erected from the extremity of the radial generator rating line OF at 100 per cent power factor will represent the apparent power of kilovolt-amperes which could be delivered to the feeder circuit by the "generator and line" if a synchronous condenser be installed for neutralizing the lagging components, such as FH, FI, etc. It is also evident that the radial lines, such as OI, OK, etc., terminating in the vertical line JL, CK, etc., erected from the extremity of the radial "generator rating" line in the position corresponding to 90 and 95 per cent power factor on the "generator and line" will represent the apparent power or kv-amp which could be delivered to the feeder circuit by the "generator and line" provided a rotary condenser be used to neutralize the lagging current represented by mJ or BK.

The scale at the right side of the diagram is laid out so that unity on it is equal to the base OF or equal to the radial line representing the rating of the "generator and line." Hence values of lagging or leading currents or kv-amp read on this scale are to be referred to the rating of the "generating and line" for their absolute values.

To illustrate, suppose that a transmission line and generating

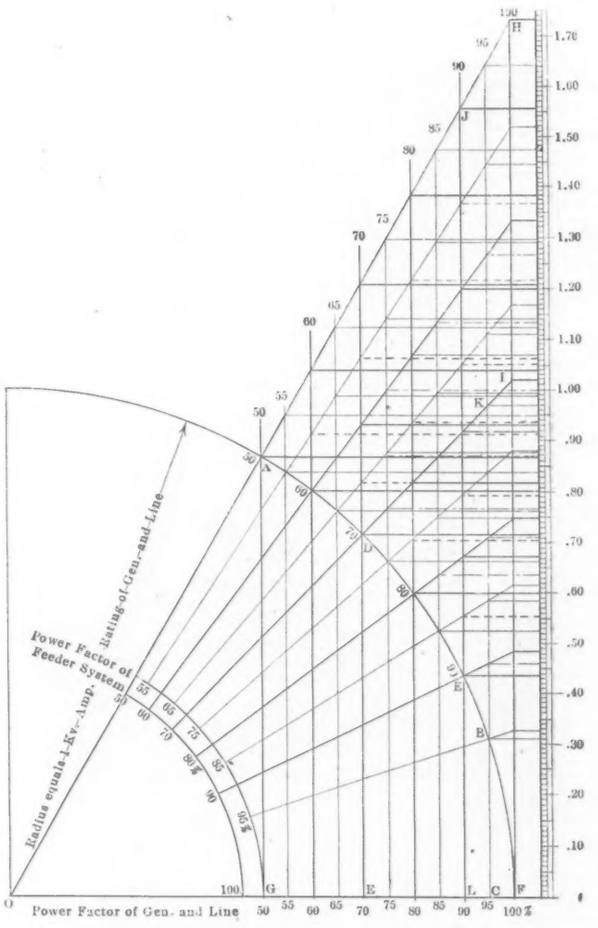


FIG. 13.—DIAGRAM FOR DETERMINING THE RATING OF ROTARY CONDENSERS FOR INCREASING THE POWER FACTOR OF EQUIPMENTS HAVING A GIVEN KV-AMPERE RATING.

apparatus be installed capable of delivering 1000 kv-amp at any power factor from 70 to 100 per cent power factor. If an inductive load of 1000 kv-amp be fed at 70 per cent power factor

only 700 kw of power will be delivered, while the generators and prime movers will be of sufficient size for delivering 950 kw at 95 per cent power factor. It is required to find the rating of a synchronous condenser necessary for raising the power factor from 70 per cent, or that existing on the feeder circuit, to 95 per cent, or that at which it is desired to operate the generators and line.

Going to the intersection of the radial 70 per cent power factor line with the vertical 95 per cent power factor line, 0.97 is read on the scale at the right. Again going to the intersection of the radial 95 per cent power factor line with the vertical 95 per cent power factor line, 0.31 is read on the scale. Hence $(0.97 - 0.31) = 0.66$, the value of the leading current or kv-amp rating required for neutralizing the excess of lagging current represented by 0.95 kw at 70 per cent power factor over that represented by 0.95 kw or 1.0 kv-amp at 95 per cent power factor. Therefore, $1000 \times 0.66 = 660$ is the kv-amp rating of the rotary condenser required. By installing a condenser of this rating the power available at the feeder station has been increased from 700 kw at 70 per cent power factor (1000 kv-amp) to 950 kw at 70 per cent power factor (1355 kv-amp).

Ozone Water-Purification System.

By G. M. Dyott.

At the present time considerable interest is being manifested in the purification of the water supply of some of the larger cities throughout the United States, and for this purpose a number of expensive filtration plants have been installed of quite elaborate design. Under the best conditions such plants only remove the silt and coarser material held in suspension and allow a large percentage of the small and harmful bacteria to pass. Any process, therefore, which will effectually and economically sterilize water will be of timely interest and of great commercial value.

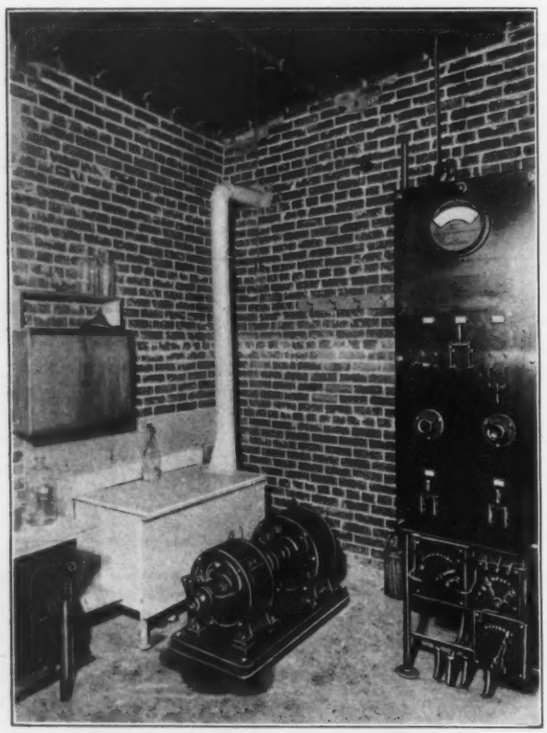


FIG. 1.—PLANT SHOWING LIME BOX, MOTOR-GENERATOR SET, ETC.

Ozone has long been recognized as a most powerful sterilizing agent, and processes involving its use for the purification of water have been in continuous operation on the Continent for the past 9 or 10 years with very satisfactory results. However, the cost of generating the ozone has been large, and the efficiency of the plants so low that its use has been confined to a few isolated instances where complete sterilization was desirable, and, in fact, absolutely necessary, regardless of cost.

In an investigation recently conducted, through Westinghouse, Church, Kerr & Company, by Mr. John F. Wallace, past-president of the American Society of Civil Engineers, in reference to the electrical manufacture of atmospheric products, his attention was directed toward the manufacture of ozone. A thorough examination of the plants and processes in Europe and America led to the formation of the Gerard Ozone Process Company, to develop and exploit the results achieved by Dr. Leon Gerard, the Belgian scientist.

The Gerard Ozone Company, 165 Broadway, New York, through its engineers and general agents, Westinghouse, Church, Kerr & Company, has recently made an installation of special interest in the application of the Gerard system at the Homeopathic Hospital, in Pittsburg. This plant has a capacity of about 250,000 gal. per 24 hours, and it is now treating 100,000 gal. during each 10-hour day at an approximate cost for electrical power of 25 cents. No attendance is required beyond an occasional visit from the engineer in charge of the hospital power plant, so that it is practically self-operative when once put in operation. The two most significant features of this plant are its low maintenance cost and simplicity of operation. The process in brief is as follows:

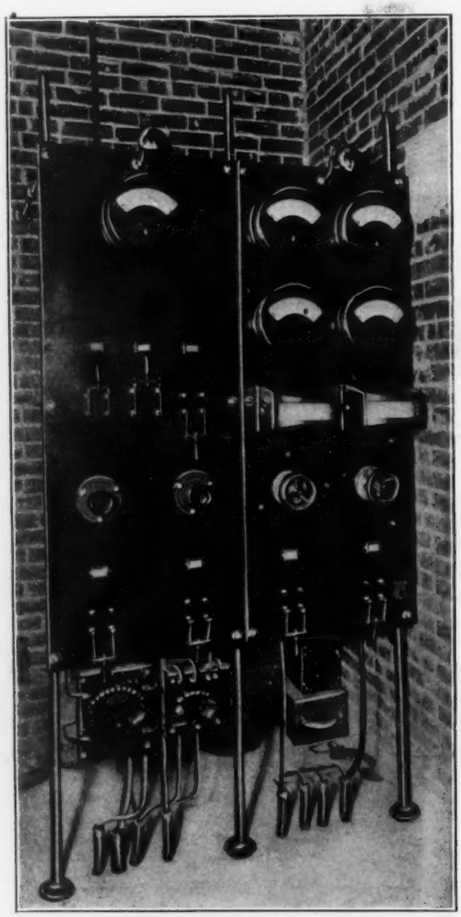


FIG. 2.—SWITCHBOARD.

Atmospheric air, after being passed through a drier, is ozonized during its passage through the Gerard apparatus; it is then mixed with the water to be purified in an injector and a further degree of mixing secured by allowing the water to flow up through a tower in which a number of perforated trays are arranged one over another. As the water overflows at the top of the tower in a small cascade any remaining ozone is removed, and the pure, sterilized water is conveyed to the general distributing tank for use as desired. At first it has a slightly milky appear-

ance, due to the entrained air, but this soon passes away, leaving the water clear and sparkling.

Ozone is not only employed for purifying water, but is also used in the operating rooms for sterilizing instruments, bandages, etc. Experiments are also being tried by introducing it in small quantities in some of the wards, where it seems to have a beneficial effect upon the patients, making them more bright and cheerful, stimulating their appetites and inducing sound sleep.

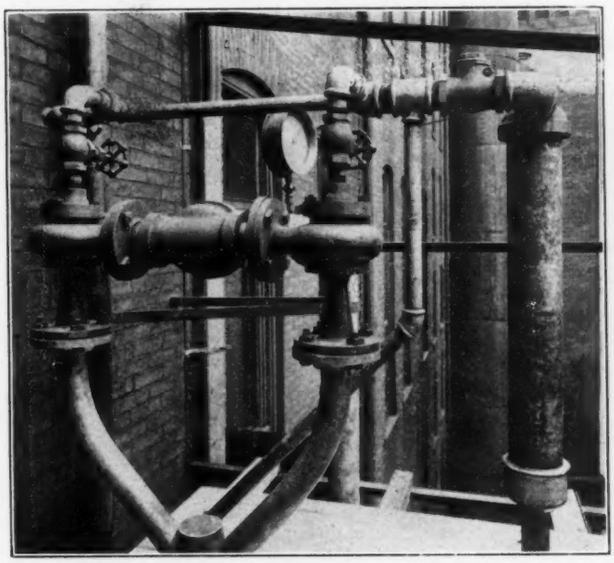


FIG. 3.—INJECTOR.

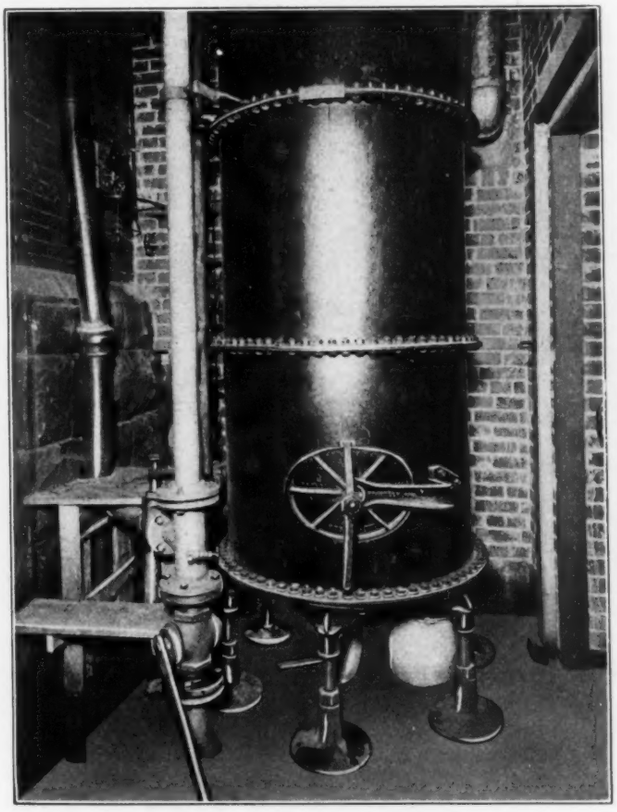


FIG. 4.—LOWER END OF STERILIZING TOWER.

Power for operating the ozonizers is supplied by a 110-volt, single-phase, 60-cycle generator direct-connected to a 3-hp direct-current motor. The alternating current is led from the switchboard over two 1-kw transformers, with 10,000-volt secondaries connected in parallel on high-tension busbars. Disconnecting switches are provided so that the load can be divided between each transformer, or all carried by a single one if desired.

The ozonizing apparatus is grouped in five units, three used for the purification of water and two for general purposes throughout the hospital. Any unit can be cut in or out as desired by manipulating the disconnecting switches. Each unit is also mounted upon wheels running on rails, so that if it is necessary to make any repairs, it can be entirely disconnected and run out into the center of the plant.

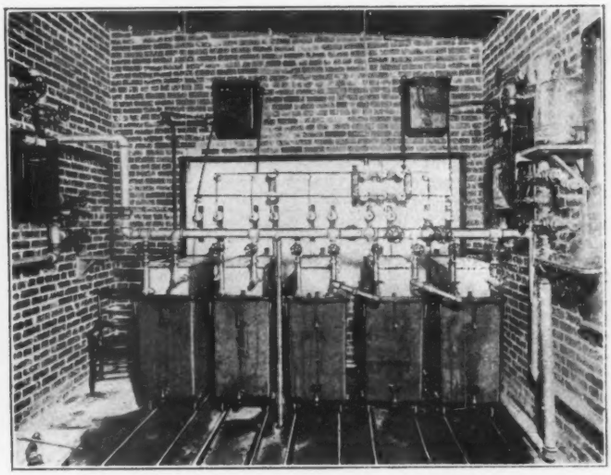


FIG. 5.—FIVE OF THE OZONIZERS, THREE FOR WATER, TWO FOR MEDICAL PURPOSES.

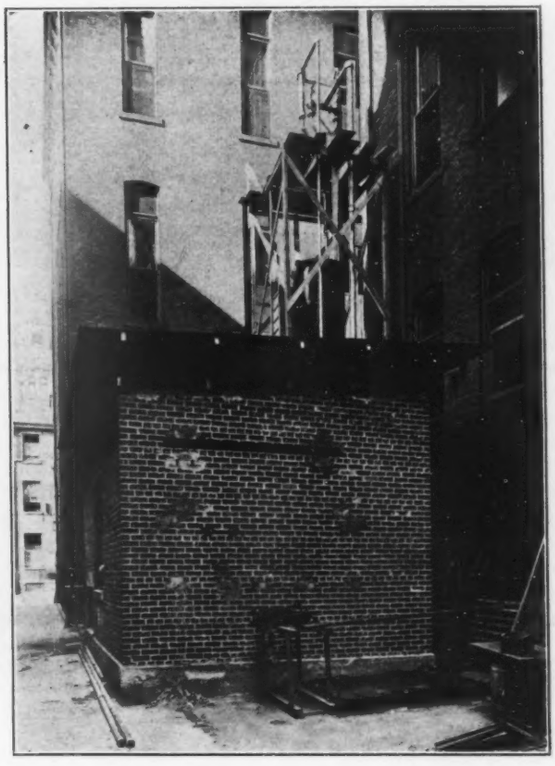


FIG. 6.—EXTERIOR OF PLANT, 18 x 20; CAPACITY 250,000 GAL. PER 24 HOURS.

In starting up the plant the motor-generator set is first thrown in and the switch on the low-tension side of the transformers closed; the water valve is then opened at the injectors, which starts the suction of air through the ozonizers. The water is

allowed to run into the sewer until the action of the ozone is properly adjusted, when it is turned off into the mixing tower. Should, by any chance, the power supply become interrupted, an automatic switch at once operates the main water valve, closing it and preventing any unozonized water from flowing into the system. The plant is controlled from a two-panel switchboard, upon which are mounted the various indicating instruments and starting and regulating rheostats.

Experience with the Pittsburg water, as taken from the city mains at the hospital, has shown that it requires about 1 gramme of ozonized air for every 200 gal. of water; this amount leaves a very fair margin of safety and ensures the absolute destruction of all pathogenic germs.

The action of the ozone upon the bacteria and carbonaceous matter is unique. Unlike that of boiling the water, it is stated not only to kill the germs, but actually to remove them, passing them off in the form of carbonic acid gas. Again, ozonized water differs from distilled water in that it has not the characteristic flat taste of the latter, but is decidedly pleasant and is not robbed of any of the beneficial salts, etc., so frequently found.

The lower forms of animal organism, which are the disease-bearing germs, are the first affected and most readily destroyed. If it is also necessary to remove the non-pathogenic germs, it is simply a question of supplying a larger volume of ozone. It has been found that this is usually not only unnecessary, but undesirable. By passing ozone through the most stagnant kind of water it can in a few seconds be transformed into the brightest, sparkling water, free from any discoloration or odor that might have been originally present.

This plant is unique in showing the highest record yet at-

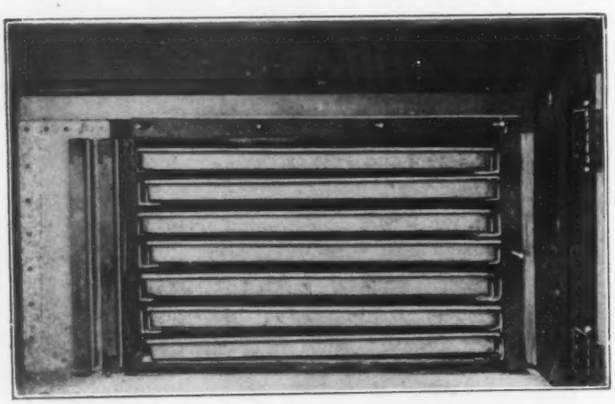


FIG. 7.—LIME BATH.

tained in the number of grammes of ozone produced per kw-hour and in the intensity thereof; it would seem to be the initial installation of this character and to mark a new epoch in water purification through the thorough commercialization of the manufacture of ozone, as the remarkably low cost of operation puts it within reach of any community suffering from impure water supply.

It is not intended that ozone shall be looked upon as an entire substitute for filtration beds in every case, but rather as an adjunct to them, the function of the filter beds being to remove sand, silt and other material held in suspension. The ozone treatment, however, is estimated to treble at least the capacity of filter beds and correspondingly reduces their cost of operation, besides removing absolutely all disease germs instead of simply a large percentage thereof.

The New Office Building of the Salem (Mass.) Electric Lighting Company.

One of the most modern central station office buildings lately erected in New England is the new home of the Salem (Mass.) Electric Lighting Company. This structure is located at 89 Lafayette Street, which is a convenient point in the central business district of the city, and it adjoins other property of the company which is utilized as the site of the power plant and the general storage premises of the organization. The company was obliged to seek new quarters, on account of its rapidly growing business, and the new building was designed for the sole occupancy of its owners. The architect was Mr. John P. Benson, of New York.

The building has a frontage on Lafayette Street of 34 ft. and

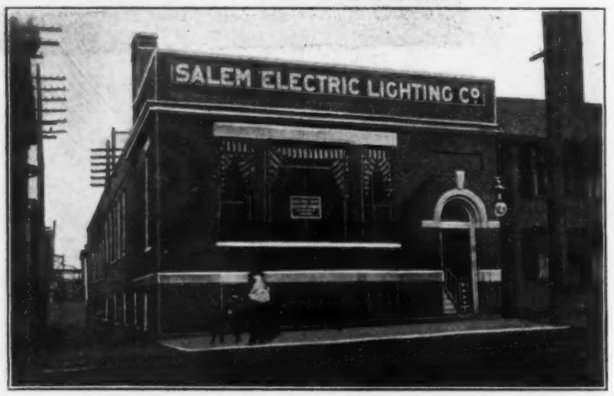


FIG. 1.—VIEW OF BUILDING.

it extends eastward for a distance of 140 ft. It consists at present of a one-story and basement structure, somewhat resembling the modern small telephone exchange building type in appearance. The walls are of hard-burned Danvers brick, carried on blocks of stone, which rest in turn upon piles. The construction is substantial enough to permit the addition of

Salem Electric Lighting Co.

No. 8713 190

Customer

Location

Purpose *Employee.*

Taken from Stock	ARTICLES.	Returned Not Used	Quantity Used	Amount Charged	
	Adjusters, Cord No.				
	Attaching Plugs No.				
	Attaching Plugs No.				
	Blocks, Moulding Rosette No.				
	Bracket Tubes, cut. No. No.				
	Bracket Tubes, cut. No. No.				
	Bushings, Socket No.				
	Canopies, Polished Brass No. No.				
	Canopies, Polished Brass No. No.				
	Casing, Polished Brass size feet				
	Cord, Cotton size feet				
	Cord, Silk size feet				
	Cord, Rubber feet				
	Cord, Window feet				
	Cleats, Porcelain kind No.				
	Cluster light No.				
	Conduit, Iron inch feet				
	Conduit, Iron inch feet				
	Conduit, Iron Elbows feet				
	Conduit, Iron Coupling feet				
	Conduit, Flexible inch feet				
	Conduit, Flexible feet				
	Crowfeet, Iron No.				
	Cut-outs, Main, No. No.				
	Cut-outs, Branch No. No.				
	Cut-outs, Enclosed Fuse No.				
	Cut-outs, S. P. No.				
	Fuses, Enclosed No.				
	Fuses, Metal Tip No.				
	Fuse Plugs No.				
	Guards, Incandescent Lamp No.				
	Handles for Lamp Guards No.				
	Hickeys No.				
	Hooks No.				
	Insulating Joints, size No.				
	Insulators, Porcelain, No. 14½ No.				
	Insulators, Porcelain, Combination No.				
	Insulators, Canopy No.				
	Leathers for Nail Heads No.				
	Nails lbs.				
	Moulding, Prepared feet				
	Moulding, Prepared feet				
	Meter Board No.				
	Outlet Boxes No.				
	Pipe, size feet				
	Pipe Hooks No.				
	Reflectors, Mirror inch No.				
	Receptacles, Wall, No No.				
	Rosettes, Porcelain No.				
	Rosettes, Porcelain caps No.				
	Screws, inch No.				
	Screws, inch No.				

FIG. 2.—STOCK ROOM BLANK FORM.

two more stories, in case they are needed in the future. The cost was approximately $20,000.

A general plan of the first floor is reproduced herewith. The main entrance leads into a terrazo-floored vestibule, from which a corridor connects with both the main counting room and the exhibition and store rooms. The counting room is on the left, and a space 20 ft. long by 6 ft. wide is set apart for

the use of the public on the outside of a counter of the former length, where bills are paid and other clerical business transacted. The counting room is 40 ft. long by 24 ft. wide and is well provided with the most modern systems of card indexing

Taken from Stock	ARTICLES.	Returned Not Used	Quantity Used	Amount Charged	
	Amount brought forward				
	Sockets, Key No. .....No.				
	Sockets, Keyless, No. .....No.				
	Sockets, Key, wall, No. .....No.				
	Sockets, Porcelain, No. .....No.				
	Sockets, Hubbell Pull, No. .....No.				
	Sockets, Waterproof, No. .....No.				
	Socket and Attaching Plug .....No.				
	Shades, Porcelain, No. .....No.				
	Shades, Porcelain, No. .....No.				
	Shades, Tin .....No.				
	Shade Holders, 2¼ inches.....No.				
	Shade Holders, 3¼ inches.....No.				
	Shade Holders, cluster.....No.				
	Strapping .....feet				
	Switches, 5 ampere, S. P.....No.				
	Switches, D. P.....No.				
	Switches, 3 way.....No.				
	Switches, Flush, S. P.....No.				
	Switches, Flush, D. P.....No.				
	Switches, Flush, 3 way.....No.				
	Switches, Knife.....No.				
	Switches, Knife, ...No.				
	Switch Boxes, Iron.....No.				
	Switch Boxes, Iron.....No.				
	Switch Gang Plate.....No.				
	Switch Gang Plate.....No.				
	Tubes, Porcelain x .....No.				
	Tubes, Porcelain x .....No.				
	Tubes, Porcelain x .....No.				
	Tubes, Porcelain x .....No.				
	Tubes, Cross-over.....No.				
	Wall Plates .....No.				
	Wire Weatherproof, No. .....lbs.				
	Wire Weatherproof, No. .....lbs.				
	Wire Weatherproof, No. .....lbs.				
	Rubber Covered, No. 6.....lbs.				
	Rubber Covered, No. 8.....lbs.				
	Rubber Covered, No. 10.....lbs.				
	Rubber Covered, No. 12.....lbs.				
	Rubber Covered, No. 14.....lbs.				
	Amount				

Checked ..... *Storekeeper.*
Checked ..... *Foreman.*
General Manager.

Form ... N. & G.

FIG. 3.—STOCK ROOM BLANK FORM.

office, the effect from the street is a highly artistic means of calling the attention of passing persons to the company's home and business. Both the general manager's and the accounting offices are provided with open fireplaces and wall outlets, from which 112-volt alternating current may be taken for demonstration purposes. All the departments are connected by interior telephones. The doors of the general manager's office are designed so that they can be opened inward as well as outward by the use of a small catch.

Beyond the counting room the main corridor leads through the exhibition room, which is 28 ft. long by 21 ft. wide, to the general stock room for supplies, including incandescent lamps, fuses, cleats, wire and fittings. The company does interior wiring for its customers, and the offices of the wiring foreman,

Fig. ... C. S. R.

Salem Electric Lighting Company.
INCANDESCENT LAMP RECEIPT.

No. 10643 *Salem,* *190*
Name .....
Street .....

NO. DELIVERED			NO RETURNED		
		4			
		8			
		12			
		16			
		20			
		24			
		32			
		Nyle.			
		Marid			
Total					*Amt.*
No. missing or broken					
DELIVERY CHARGES					
TOTAL CHARGES					

Received by
Delivered by
Returned by
New Work No. *Renewals No.*
Remarks

FIG. 5.—STOCK ROOM BLANK FORM.

and record keeping, also including adding machines, interior telephone service and a fireproof vault, 8 ft. long and 6 ft. wide, with toilet facilities on either side. The lighting of the counting room is sectionalized by flush wall switches, and in the center of the room a four-glower Nernst lamp is installed for exhibition purposes. The floor is of birch, and the front of the building is finished in cypress. The front and rear of the building are separated by a fire wall 1 ft. thick. All the

the superintendent and the assistant general manager are located at one side of the building opening out of the exhibition room convenient to the stock room. These smaller offices are about 10 ft. long by 8 ft. wide, the interior wiring foreman having slightly larger quarters, on account of the frequent consultations necessary in his work. An automatic firedoor separates the exhibition room from the front corridor. The former room is provided with a counter and facilities for the demon-

FIG. 4.—FIRST FLOOR PLAN OF SALEM ELECTRIC LIGHTING COMPANY.

windows on the office floor except those in the general manager's office are of transparent wired glass construction.

The general manager's office is located at the front of the building and is 25 ft. long by 17 ft. wide. It fronts directly on the street and is easily accessible from both the general counting room and the waiting space outside the latter. This room has an oak floor and is equipped with furnishings for directors' meetings, with desk room for the treasurer. It is admirably lighted by a maximum of six 125-watt Gem lamps, which can be cut in and out in pairs. A central chandelier with incandescent lamps enclosed in translucent globes is provided, and, as this hangs directly in front of the 8-ft. central window of this

stration of apparatus. Every customer who goes to the stock room for the renewal of lamps or the purchase of supplies is obliged to pass through the exhibition room.

The stock room offers the most complete facilities for storage, with provision of tiers of bins and drawers for the lighter fittings and bench space for their repairing. At the rear of this room is a rack for testing arc lamps, and a direct-current circuit is brought in for charging automobile batteries. Two of the forms used in the stock room are shown. The smaller is an incandescent lamp receipt, and it is designed to record the number of each kind of lamp received, delivered, renewed free or paid for by the customer, on account of loss or

retention, with the sizes exchanged, the date and the customer and employee concerned. This is made out in duplicate, one copy going to the office and the other being held by the stock room. The larger form covers the wiring fittings used by the company's employees and accounts for all equipment taken from stock, used or returned. This is checked by the storekeeper and the foreman and is approved by the general manager before being passed to the counting room.

At the rear of the stock room is provided an electric elevator for freight service, with a lifting capacity of one ton. The elevator is driven by a 10-hp General Electric 220-volt motor of the induction type, the starting lever being operated by means of a hook rod kept in the stock room, which does away with the inconvenience of a rope. At the rear of the building adjoining the elevator shaft a platform is provided for unloading stock, and an overhead beam has been set into the wall to enable a block and fall to be attached, in case very heavy supplies or apparatus require careful handling into the building. All the rear section of the building is finished in Southern pine.

The basement is divided into two sections separated by a fireproof wall. The front is devoted to the storage of heavier line materials, lamps and wire. Two fireproof vaults are included in this section, and as the building is surrounded on all sides by streets or passageways, special care was taken to provide a water supply for use in case of fire, with hose and chemical extinguishers. An inclined entrance from the alley on the north side of the building is provided to facilitate the receipt and delivery of line materials. The rear part of the basement contains a locker and lavatory for the outside employees, 24 ft. by 12 ft., and a work room, 36 ft. by 15 ft., where miscellaneous repairs are effected on arc and Nernst lamps, signs and where odd jobs are done. This room has a small motor-driven grinder in its equipment. Motors are stored in the basement for immediate shipment to customers. The basement windows are of translucent wired glass. On the outside of the building the company's name is set in incandescent lamps, and on the roof a steel wire frame is erected in readiness for line service. The principal officers are: President, C. H. Price; treasurer, H. M. Batchelder; general manager, S. Fred Smith, who is also president of the New England Association of Electric Lighting Engineers; assistant general manager, A. Morrill, and superintendent, H. Kingsley.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Exposed Bases of Incandescent Lamps.

The Underwriters' Laboratories, Chicago, has issued a circular calling attention to a rule of the National Electrical Code which prescribes that no live parts of an incandescent lamp base shall be exposed when the lamp is in the socket, and stating that some of the new high-efficiency lamps have exposed skirts not insulated from the circuit and therefore do not conform to the rule.

Street Illumination by Series Tungsten Lamps.

The accompanying illustration gives a view of Canal Street, Grand Rapids, Mich., as illuminated by series tungsten lamps. The installation consists of 15 spans across the street, with 18 60-cp, 75-watt tungsten lamps in series on each span. The spans

STREET ILLUMINATION BY TUNGSTEN LAMPS.

are 100 ft. apart, thus illuminating about 1500 lin. ft. of space, and about 110 ft. in width.

The initial expense of the installation for material and labor was practically $50 per span, or $750 total, divided among so many merchants in the association that the individual initial expense was very small. The Grand Rapids-Muskegon Power Company entered as one of the merchants, because of its retail store, and stood its pro rata share of the expense. The Grand Rapids Electric Company, a supply dealer, secured the contract for erection and furnished the material.

The installation is permanent, and if the life of the tungsten lamps shows 1500 hours or more the power company considers that the annual income of a thousand dollars is attractive from an earning standpoint. From the standpoint of the merchants the proposition is exceedingly attractive, as it is considered to be a forcible advertisement for their business. Since the installation was made the crowds of people who flock to that street offer ample evidence of its success from an advertising point of view.

As to the expense of operation for the merchants, it is so divided among the large number of them as to be small, some of them paying not more than $1 a month. The power company made a special feature of billing separately to the merchants, thus making the least trouble to the association.

Considered from all standpoints the installation seems to be very successful. It is too early, however, to give detailed information about the life of the lamps. It is considered to be a masterpiece electrically. The power company justly feels very proud of this installation, but the greatest pleasure lies in the intense satisfaction which has been exhibited on the part of the merchants and citizens in general.

Introducing Electric Heating Devices.

In a paper read last week at the Grand Rapids convention of the Michigan Electric Association, Mr. H. A. Mott gave his experience in introducing electric heating devices. The central station, which is in an Eastern city, had an extremely good lighting load and very moderate day load of small motors, and it was decided to see what could be done to increase the day load. To begin with, there were installed on the lines one complete cooking outfit, 12 flatirons, six percolators, sewing machine motors and chafing dishes. It was arranged to give a 5-cent per kw-hour rate to all persons who wired up separately for a complete kitchen outfit or luminous radiator. For these was installed a separate meter, with a minimum rate of $1 per month.

The campaign was opened up with a two weeks' demonstration in a large department store, which demonstration was advertised in the daily papers in full-page advertisements. The demonstrators gave talks twice a day, besides demonstrating the use of the various utensils. This was so successful

that it was decided to continue another week, making in all three weeks. The demonstration appeared to have been a failure, for, although visited by over 20,000 people, not more than half a dozen pieces of apparatus were sold, but at the end of the season it was found to have been an excellent advertisement.

It was then decided, since the people had an idea of electric household apparatus, to start with the electric flatirons and a house-to-house canvass. For this purpose a wagon was sent out, with three boys, and having large signs on each side, stating that the company would put out electric flatirons on free trial for three weeks. As it was a little dubious as to the number that could be put out and kept out, it was decided to place an iron only in every other house or flat. The boys were given cards to be signed by each person taking an iron, which were turned in each day and filed under the date that they would be due. In this way the wagon was able to put out on an average 25 irons a day. At the end of three weeks when calls were made, it was found that on some days 10 would come back, on other days none. The results showed that on an average over 20 irons were kept, and many people who had returned them at the end of the three weeks came in afterward and bought one.

The object in not delivering them to every house, but to every other house, was twofold: First, to spread the irons over a large territory; second, to arouse the interest of the people who might think they had been slighted while their neighbors had been favored. A surprising number of telephone calls and visits were received from indignant housewives, who wanted to know why Mrs. So-and-So was favored and they were not, and who guessed they used as much current as she did and paid their bills just as promptly. An iron was sent at once, with an apology, and one boy was thus employed; it was a trifle more expensive than if it had been delivered at first by the wagon, as the boy could only carry three or four of them at a time, but, with very few exceptions, irons taken out this way stayed out.

At the same time sewing machine motors, percolators, water heaters and chafing dishes were pushed and the advertisements changed weekly. At the end of the summer there were installed 800 electric flatirons, 9 complete cooking outfits, 20 percolators, 13 luminous radiators, 30 sewing machine motors and 35 chafing dishes, besides a considerable number of hot-water heaters and cigar lighters.

It was found that the income amounted to $6 per year for each flatiron, $48 per year for each kitchen outfit, $12 per year for each luminous radiator and $1 a year for each percolator and sewing machine motor. Chafing dishes, hot-water heaters and cigar lighters were not taken into account. The smaller articles do not bring in income directly to the central station, but are the best advertisements for the larger articles from which an income can be derived.

In summing up, if the majority of small central stations would start in and push a number of the smaller articles they would soon find that they would be creating a demand for the larger current-consuming devices. As most of those devices are used from an electric socket, it means no additional expense in the way of service and transformers to the stations or in the way of wiring to the customers; yet the stations get a day load not at motor rates, but at lighting rates.

Central-Station Power Load.

Below is given an abstract of a paper entitled "Campaigning for Power," which was read by Mr. E. L. Crosby at the Grand Rapids meeting Aug. 18 of the Michican Electric Association:

In undertaking to secure a day load for a central station, the first requisite, he said, is a system equipped and operated to give reliable and efficient service; and second, rates low enough to compete with steam costs, for, in introducing central station service in a community, few manufacturers will be found willing in the beginning to put a money value on the superiority of electric power. As the load factor of a station improves, however, rates that are initially too low from the central station standpoint become gradually more profitable.

The first step in the campaign is to learn the possible business within the limits of the territory reached by the station lines. Among power users will be found some whose plants are operating under modern conditions and with a very high percentage of efficiency. A second class comprises plants in fair condition and giving moderate economy in operation, but where central-station service would doubtless mean an improvement in operation, but with no actual financial saving incident to making a change. But the majority of plants will be found to be operating with wasteful mechanical equipment, high labor costs and some under unsanitary conditions. There are also the small plants, the output of which is so little and the hours of operation so few that individual power production is ridiculous. The last two classes are those on which to spend the greatest effort to secure business.

The first and most essential movement in dealing with the prospective customer is educational. He will ask the station representative the cost per horse-power per month and insist that this figure, multiplied by the capacity of his present gas or steam engine, or by the maximum requirements of all his machinery, will be his cost per month on central station service. If this were true, electrical drive would not have had the phenomenal growth it has experienced in the past decade, and it is up to the power solicitor to convince the prospective customer of the fallacy of his premises.

Actual tests have shown that the load factor of machine shops and wood-working plants, which constitute a large percentage of the average central-station load, is below 35 per cent; consequently, the manufacturer who installs, say, 100 hp in motors, will find that the load which determines the rate which he pays will be practically one-third of the capacity necessary in a steam or gas-engine drive.

The successful solicitor should understand indicating steam engines, as in this way he is able to determine the actual effective power required as well as the friction loss which may be excluded by the use of motors, and thereby arrive at a very close estimate of the cost of operation by his service. It is necessary that he shall be familiar with the efficiencies of various gas engines under different load conditions, as by checking the gas consumption of the engine while running, it is a very simple matter to figure the average load and hence make a comparative statement. In dealing with new installations, the solicitor should have a thorough knowledge of the power requirements of the various machines under the requisite load conditions. In this connection a record of tests taken on the various motors on the system, together with description of the class of work on which they are employed, will prove invaluable as a reference.

In competing with gas engines, the solicitor will find that his prospective customer very seldom figures any cost other than the gas bill sent him each month, and here it is necessary for him to bring out in as impressive a way as is possible the cost for lubrication, cooling water, repairs, attendance, etc., which will in most instances amount to $1 per horse-power per month. These items are usually lost sight of in the factory not having a regular system of figuring power costs.

The steam user very often neglects to figure such items as depreciation, interest, etc., and when these things are forcibly brought to his attention, his ideas in regard to his cost for power are likely to change.

Added to these savings, which may be figured through access to the customer's costs, there are many other points which at first thought appear to the average power user as negligible, but which he eventually appreciates are of solid value. These features, such as reliability, or not being dependent on one unit for service; flexibility, or ease with which additional power may be installed at small expense; increased output, owing to constant maintenance of the speed of the maximum efficiency, this also effecting better finish of product; the elimination of noise, dirt, smoke and the various annoyances that arise from any isolated power plant; prosecution by smoke inspectors (very acute in some localities); and last, but not least, that "peace of

mind which passeth all understanding" which invariably comes to the man whose shop enjoys central-station service.

Very little trouble should be experienced in securing the business of the small steam user, say up to 50 hp. The writer in several instances secured business where the entire shop, after the change, was operated for less than the engineer's salary alone. In one plant where the engineer was paid $60 per month and coal consumed cost $20 per month, the shop was driven by one motor for less than $25 per month, and the owner sold monthly $10 worth of shavings formerly burned under his boiler. Of course, this is an exceptional case, and one in which the owner had contemplated electric drive for years, but hesitated for fear the service would prove too expensive.

To demonstrate to the prospective customer that motor drive will prove economical in his plant, a trial installation is often very effective. Ninety per cent of the people using power are willing to pay a little more for central-station service than for any other form of power, after they have once had experience in its use; and if the prospective customer can be induced to allow an installation for 30 or 60 days free of expense other than for current consumed, with the understanding that the apparatus will be removed in case of failure to satisfactorily operate his shop, he will usually be ready to sign a contract at the end of the trial period.

Until such a time as the central station creates a demand for power, few contractors or supply dealers will be found ready to make an investment necessary for an adequate motor stock. When the Detroit companies started out seriously to secure power business, a stock of motors was purchased from which were loaned, rented and sold motors to power customers. After about 18 months, one of the local contractors, recognizing the business to be had in this field, secured the agency for one of the standard makes of motors and put in a good stock. Several others have followed suit and to-day the local contractors are able to take care of the motor part without the aid of the central station. With the present co-operation, a motor salesman necessarily "boosts" central-station service in trying to sell his motor, and the matter is brought to the attention of the prospective customer oftener than were but one man handling the entire deal. To this end it is helpful if the motor salesmen of the town are familiar with the rates of the company selling current; otherwise they are likely to confuse the prospective customer as to the probable cost of service.

The solicitor should be able to furnish to the customer figures not only on the cost of service but also on the cost of motors, wiring, etc.; he should be able to lay out the most satisfactory method of driving the shop, eliminating as nearly as possible all friction losses, at the same time avoiding overmotoring, which in some plants will increase the investment enormously without effecting any practical saving. He should know the type of motor best suited for various types of machinery; in short, he should know the salient principles of engineering together with a liberal allowance of good salesmanship.

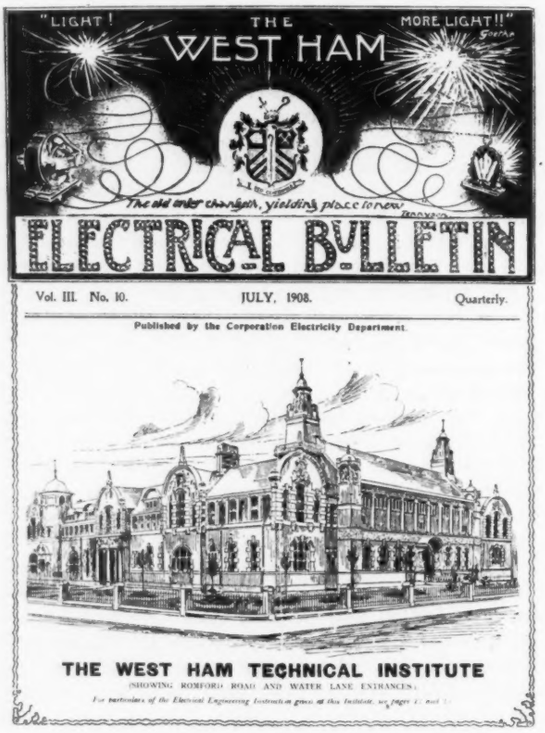
The solicitor's duties have by no means ceased the moment he secures the customer's signature to a contract. One customer who is dissatisfied but uses service because he is bound by contract, will do the business more harm than a dozen satisfied patrons can counteract; and the solicitor should in such a case be in a position to offer suggestions in regard to changes in operation, form of contract, or in some way effect a satisfactory settlement of the matter, convincing the consumer that the company is doing all in its power for him instead of "robbing" him, as is the common expression of the public in regard to most public-utility corporations.

Finally, the office should co-operate with the field force in handling customers, practising courtesy and attention with all inquirers, making the entire sales department a unit in fixing for the electric-service corporation its place in the public mind as a benefit to the community. To this end, an inquiry clerk, familiar with the company's rates, knowing the company's policies, and having plenty of time to tell the man what he wishes to know, is a valuable adjunct.

An Enterprising Central Station Bulletin.

The *Electrical Bulletin,* published quarterly by the West Ham, England, municipal central station, is an excellent example of what a publication for advancing the interests of a central station should be. While its reading matter is of a kind to interest the general public to which it is addressed, the main purpose of the publication—to extend the use of the municipal electrical service—is never lost sight of. Aside from matter directly in the commercial interest of the West Ham plant, there is in each issue a biographical sketch of one of the electrical pioneers—Galvani being the subject in the current number; an installment of a series of articles entitled "Mankind's Debt to Electricity," which describes in non-technical language the history and application of the more important electrical discoveries; and stories and notes, humorous and otherwise, hitched to something electrical. There are also several clever cartoons in each number.

Other matter consists of illustrations of notable new connections to the West Ham service, new electrical applications and



FRONT COVER OF "ELECTRICAL BULLETIN."

devices, plant improvements, etc. A notable feature of the commercial section consists of statements from customers giving their experience with electrical service, of which several are reprinted below:

"First of all, let us hear what Mr. J. B. Hawes, hosier and outfitter, High Street, Stratford, says concerning the electric light:

"'By way of a beginning, I may as well tell you that since adopting the new Osram lamps my bills for electric lighting have been considerably less than they were before I commenced using them, e. g., for the first quarter that they were installed (the one ending December, 1907), the account was nearly £9 lower than it was for the corresponding quarter in 1906—to me a welcome difference.

"'The color of the light given by these lamps is a good one from a hosier's standpoint, being one that shows off all classes of our stock to advantage, and far superior to that given by the small electric lamps previously used.

"'With regard to the cleanliness of the electric light, all I can say is, look at the ceilings and the shop generally; nothing has been done by decorator or painter to either of them since

the electric light was installed five years ago, and yet they look almost as fresh as the day they were done. In my old premises, where we used gas, the ceilings had to be done once every year at least.

"'As to the all-around effect on every description of hosiery and outfitting stock by substituting electricity for gas, I have noted the following advantages:

"'1. A saving on all rubber goods, such as elastic webs, mackintoshes, etc.

"'2. All kinds of woolen goods can be kept in first-rate condition, and never get "perished" or "tender," as was often the condition of such things if placed above a certain height in the days when gas was used.

"'3. No trouble from linen goods, such as white shirts, collars, cuffs, handkerchiefs, etc., turning yellow, as in the old gas days.

"'4. We are now able to economize space by carrying our fixtures to the ceiling, which was impracticable in the days of gas lighting.

"'5. Leather goods, such as portmanteaus, bags, purses, etc., are all easier to keep in a sound and salable condition; as the heat and fumes from burnt gas are liable to cause every description of leather to crack or become "perished."

"'6. The outsides of packages and boxes of all kinds keep cleaner with the electric light than with gas, which naturally makes a lot of difference to the general appearance of the shop.

"'Finally, good stock-keeping has been a much easier task for us since we discontinued the gas and put in the electric light.'

"Now we will listen to the opinions of Mr. J. S. Rush, jeweler, 24 Upton Lane and 78 Woodgrange Road, Forest Gate, on this matter:

"'I originally began business at 14 Upton Lane, and, while there, had the electric light installed as soon as possible. I at once noticed that larger numbers of people looked into my windows than formerly; furthermore, electric light made a difference of some pounds in my first week's takings, which I can only attribute to the goods being rendered more attractive in appearance thereby. In my opinion the light given by the new metal-filament electric lamps is more suitable in color and general character than any other to show off to the best advantage gems of every description, as well as gold, silver and electro-plated goods; in fact, practically all the items of a jeweler's stock look well under their rays.

"'It is, of course, hardly necessary for me to say that silver and electro-plated goods are easier to keep clean and untarnished where the electric light is used than where gas is being continually burned. Again, the surfaces of marble and ormolu clocks are liable to become "pitted" by the sulphurous fumes given off by gas—a jeweler that uses the electric light is never troubled in this way.

"'Perhaps the following story may interest some of your readers: I recently advertised for an assistant in my workshop. Among the replies to this advertisement was one from a young man saying that he should like the situation, but added: "I cannot work by gas; I have had to give up a berth through it, owing to bad health induced by the fumes therefrom. The doctor told me that I might continue at the trade in any shop that was lighted by electricity, but not under any conditions where gas was being burned."

"'That,' said Mr. Rush, 'is a testimonial for electric light which should be of some value to you.'

"Needless to say, our representative agreed with him.

"Finally the views of Mr. H. G. Sutton, tobacconist, 394 Green Street, Upton Park, on the benefits of electric lighting should be interesting to most retail tradesmen, but certainly to all tobacconists who are still using gas for lighting their premises:

"'Since I began using electric light I have saved a considerable sum on decorators' bills, for the simple reason that the shop has not been done up since it was installed over four years ago, though, of course, the boy who cleans the windows has washed over the ceilings occasionally to remove the dust that gradually accumulates on them. While I had the gas, the shop at least had to be painted every year to keep it in a smart-looking condition; besides, the convenience to a business man whose shop is open every day in the year till 11 o'clock at night of not being compelled to have the painters and decorators in each year is a great argument in favor of electric lighting.

"'One important advantage, from the trade standpoint, of using the electric light consists in the keeping of cigars in condition when once they have been brought into that state. The objection to gas is that it produces great and sudden changes in the temperature; whereas to keep cigars in prime condition the temperature requires to be maintained as even as possible. Again, cigars need a certain proportion of moisture in the air where they are stored, while in most gas-lighted shops the air is frequently robbed of this necessary amount, with the result that numbers of cigars (especially among the Havanas and higher-class qualities) lose all their flavor and are thus rendered quite unsalable. The evenness of temperature and the preservation of a proper proportion of moisture in the atmosphere, to which I have just referred, are both comparatively easy conditions to maintain in an electrically-lighted shop.

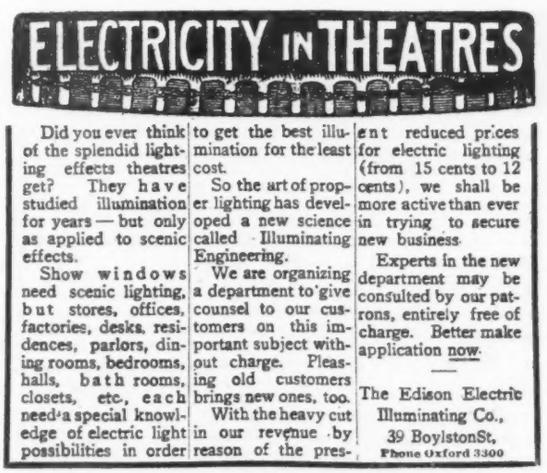
"'As regards the cost of the electric light, you may perhaps be interested to know that in consequence of using the new Osram electric lamps I have saved about £20 last year on my lighting bill; this saving represented the difference in current consumption between the Osrams in use from December, 1906, to December, 1907, and the ordinary small electric lamps that were used from December, 1905, to December, 1906, and I have got a much better light into the bargain, which makes the exchange of the new lamps for the old a doubly satisfactory one to me.'

"We heartily commend the above statements to the notice of our non-consuming hosier, jeweler and tobacconist friends in West Ham—and elsewhere."

INTERIOR WIRING AND ILLUMINATION

Boston Edison Company Illuminating Engineering Department.

A regular department of illuminating engineering will be established about Sept. 1 by the Edison Electric Illuminating Company, of Boston. The purpose of this branch of the organization will be to advise customers as to the best illuminating engineering practice and to help them get the best lighting for a given expenditure. The department will be a subdivision of the office of the general agent, Mr. R. S. Hale, and the work


ELECTRICITY IN THEATRES
Did you ever think of the splendid lighting effects theatres get? They have studied illumination for years — but only as applied to scenic effects.
Show windows need scenic lighting, but stores, offices, factories, desks, residences, parlors, dining rooms, bedrooms, halls, bath rooms, closets, etc., each need a special knowledge of electric light possibilities in order to get the best illumination for the least cost.
So the art of proper lighting has developed a new science called Illuminating Engineering.
We are organizing a department to give counsel to our customers on this important subject without charge. Pleasing old customers brings new ones, too.
With the heavy cut in our revenue by reason of the present reduced prices for electric lighting (from 15 cents to 12 cents), we shall be more active than ever in trying to secure new business.
Experts in the new department may be consulted by our patrons, entirely free of charge. Better make application now.
The Edison Electric Illuminating Co.,
39 BoylstonSt,
Phone Oxford 3300

BOSTON NEWSPAPER ADVERTISEMENT.

will be in immediate charge of Mr. H. W. Moses, with Dr. Louis Bell as consulting illuminating engineer. An example of the company's methods of bringing the new department to public knowledge is shown in the accompanying reproduction of a newspaper advertisement on page 453.

Wiring Contractors.

Considerable discussion has resulted in Great Britain from an announcement of the Birmingham municipal central station that it has decided to publish a list of wiring contractors who are authorized to carry out work within the city limits. A journal devoted to the interests of contractors, the *Electrical Field*, has obtained a legal opinion as to lawfulness of such an action, the text of which follows:

"It appears that the removal or non-inclusion of the name of a contractor is calculated to create prejudice against such contractor in the minds of prospective consumers, influencing them against dealing with him. As no legal responsibility rests upon the corporation to publish such a list of authorized contractors, it is possible that the corporation might find itself involved in endless litigation with contractors who had suffered by such action.

"The consumer has a perfect right to entrust his work to any contractor he pleases, and if any person or persons, either directly or indirectly, influence such consumer and induce him to withdraw his custom from that contractor, then that contractor has a right of action against such person or persons inasmuch as it would amount to wilful coercion of the consumer and a violation of the rights of the contractor."

House Wiring by Central Station Companies

To the question "Should central stations do wiring?" discussed at the annual convention of the Ohio Electric Light Association, an affirmative answer was given by Mr. E. F. Gwynn, while Mr. C. C. Custer answered in the negative.

Mr. Gwynn claimed that in cities having less than 15,000 inhabitants house wiring is done satisfactorily by local contractors. It is the duty of the central station to insure that all new buildings are properly wired, both for the sake of its own future income and for the interest of the owners of the buildings. The busy manager of a small central station can well afford to obtain the services of a first-class assistant to relieve him of many duties, provided he undertakes house wiring at a profit. Moreover, as much benefit can be derived from the wiring department through other channels as from the actual profit on the business done.

Mr. Custer expressed the opinion that instead of being a participator in house-wiring the central station should be a co-operator. The function of the central station is primarily the generation and sale of electrical energy, and all of its efforts should be exerted along these lines. It is possible for private contractors to do the wiring properly, and these contractors should have the moral support and co-operation of the central station.

There are several ways by which the central station can influence the character of the wiring—first, by influence with the wireman himself and inspection of the installation when it is ready to be connected; second, by getting the underwriter's supervision and inspection on as many jobs as possible; third, by furnishing to owners or architects plans and specifications free of charge for the larger and more pretentious installations. An effective way of getting in touch with the builder is to keep a record of the building permits as taken out and mail to each applicant for a permit a letter setting forth the desirability of having his house wired for electricity, offering the services of the company's illuminating engineer free of charge in an advisory capacity, and perchance inclosing a blank wiring specification. By properly getting in touch with a prospective customer at this stage it is possible to gain his good-will and make a friend of him before he becomes a consumer; in fact, the central station manager can do a great deal to overcome the usual conception many people have that the electric light company is a grasping corporation trying to make a profit off them at every turn.

The Contractor and the Central Station.

At the Grand Rapids meeting Aug. 18 of the Michigan Electric Association, Mr. George Lewis presented a paper entitled "Ideal Relations Between the Central Stations and the Contractor," an abstract of which appears below.

Referring to the relations between the central station and the contractor, these, he said, should be co-operative in character; both are depending upon the sale of electrical energy for their livelihood and prosperity, and more can be accomplished when both are pushing than when they are antagonizing, each other. Unfortunately, there exists in many places about the country a lack of this harmony, a working at cross-purposes, that cannot be helpful in its effects upon this industry.

The contractor suffers because the central station invades his legitimate field by competing with him in construction and repair work, and by selling apparatus at a profit that is ruinous to the contractor. The central station may justify such a policy by a desire to create a sale for the product, and may think the contractor cannot do much for it in this capacity. Whatever the reasons are, this kind of policy is responsible for much of the bitterness which now exists between these two branches of the electrical business, a friction as foolish as it is harmful.

The primary feature of the central station's business is the sale of electrical energy; and all other parts of it being secondary, and therefore of less importance, it would seem that the most profitable policy to adopt is the one that will yield the greatest results to the primary purpose.

The most essential thing for the central station is to first create a friendly public sentiment, and after having obtained it, to keep it. This requires the maximum of harmony and diplomacy, and to have this every firm and individual engaged in the electrical business must be considered. If the contractor is a competitor, he is a disturber, and therefore a source of irritation, so far as his influence for or against the central station is concerned.

The central station should do no construction work, except on very small jobs where they come into close competition with the gas company and want to displace a gas arc or something of this nature. Their solicitors should obtain house wiring and other contracts and turn the work over to one of the local contractors, being careful not to show partiality. In return for this consideration, the contractor should establish a schedule of prices for wiring houses and other small buildings that is equitable to all concerned, and this schedule should be used by the central station solicitors in going after all work, as it would enable them to estimate almost any job quickly and intelligently, thus saving time and not arousing a suspicion in the mind of the prospective customer that someone is trying to rob him, as is too often the case when this co-operation is lacking and bids of varied amounts are submitted. This schedule plan has been attempted in some quarters with more or less success, and has attracted some attention by becoming the subject of comment in a congratulatory way, by the electrical press in many parts of the country. By turning this business over to the contractors on this schedule plan, the central station is enabled in a great degree to regulate this class of work. It has a record of the transaction, a uniform price is maintained, and justice secured to the customer, and the contractor secures his legitimate profit.

The contractor, in turn, should use his influence in every way to create satisfied customers for the central station, and it would be possible for him to allay much criticism that is unjustly directed at the central station. Too often the contractor takes a negative position so far as the central station is concerned, in advising the customer to cut down his connected load and reduce his bills. It would be much better for him not to emphasize a reduction of bills, and, therefore,

less consumption of current and a reduction of profit to the lighting company, but instead, to advocate more light. The customer is not so concerned about the amount of his lighting bills as he is about the quality and quantity of the illumination he is getting for the money expended. A co-operative policy of this kind would do much to eliminate this source of annoyance, and the contractor would thus become a positive instead of a negative factor in his relation to the central station.

The central station could go further than this. It could make it possible for the contractor to purchase various heating devices, fans, fixtures, etc., by combining their requirements, and thus buy in such quantities as would secure the minimum cost. This would enable them to establish mutually a re-sale price representing a fair margin of profit, and everyone could sell the same article at the same time, and at the same price; this, with simultaneous advertising and window display, would yield better results. Another good feature of such an arrangement is that one manufacturer's flatiron, toaster, heater, etc., could be used, which would reduce the annoyance of the customer in procuring renewals, occasioned by the use of many different brands of the same device. The possibilities in this line are almost limitless.

The central station should show consideration for the contractor and supply dealer, by giving them a list of its prospective motor and apparatus customers, that all may be a solicitor for the man who wants to sell energy. It should be impossible for anyone to sell any apparatus at cost or below retail prices, and the central station should place itself in a position not to do anything to reduce the contractor's profits, or in any other way belittle him.

This policy would give the central station a restraining power that no other policy could possibly secure. If the contractor or supply dealer is tempted to introduce and push the sale of some new device or product, that for some technical, engineering or other reason the central station deems inadvisable to adopt, the fact that co-operation is so beneficent in its results to the dealer or contractor would restrain them from yielding to any temptation that would embarrass an ally and friend.

The National Electrical Contractors' Association—Its Growth and Work.

BY W. H. MORTON.

In the year 1901 the electrical contracting business had hardly risen to the dignity of a recognized position in the building trades of the country, and almost anyone with a screwdriver or pair of pliers advertised himself as an electrical engineer and contractor. This condition made the reputable contractors feel that something was necessary to improve the trade conditions, and they believed that such improvement could only be brought about through an organization that was national in its character.

With this end in view a meeting was called in Buffalo, N. Y., on July 17, 1901, to discuss the advisability of forming a national organization composed of electrical contractors. It was evident from the attendance at and interest in this meeting that such an organization was believed to be a necessity throughout the country. Many delegates who attended this first meeting represented a number of contractors from the cities in which they did business and consequently were unable to take definite action at the time of the meeting. The sentiment, however, was so strongly in favor of an organization that the National Electrical Contractors' Association was formed at this meeting with a membership consisting of 31 contracting concerns.

From then until the present time there has been a steady growth, and the organization now has a membership covering practically the whole country and including a large proportion of the electrical contractors. The object of the organization is to improve the conditions in the contracting trade in every possible way, and working with other national organizations in the electrical field it has brought about the favorable recognition of the electrical contractor and made the electrical contracting business a factor in the building industry which cannot be ignored.

The association has a board of directors composed of prominent electrical contractors throughout the country, and this board is at all times ready to take up any question that the membership deems important. The special work of the organization requiring constant attention is handled through committees.

One of the most important subjects which confronted the contractor was the question of wiring rules and the inspection of electrical work. A committee was appointed in 1902 to take up this subject, and the work of this committee resulted in the organization being allowed the privilege of the floor at the meetings of the Underwriters' National Electric Association, and also of membership in the National Conference on Standard Wiring Rules. The policy of the organization has been to make rules more definite and strict in order to raise the standard of electrical construction work. Also, to bring about a uniform interpretation and enforcement of the rules as embodied in the National Electrical Code, and much progress has been made along these lines.

The matter of legislation for the licensing of electrical contractors is another matter of great importance to the trade, and the National Association has advocated the passage of proper license laws, both by state and municipal government. The committee dealing with this subject has collected and is still collecting valuable data, which is furnished to any of the members that desire to take up the question of such laws.

Another subject that early occupied the attention of the association was the difficulty in figuring electrical wiring installations on account of the different symbols in use by the different architects and engineers. Feeling that a uniform set of symbols would be of great benefit, not only to the contractor but also to the architect and engineer, a committee was appointed to take up this subject. The work of this committee resulted in the adoption of a set of standard symbols, which has been adopted by the American Institute of Architects and several departments of the United States government. The use of these symbols saves the contractor much annoyance and lots of time in making estimates, and prevents many misunderstandings.

Along this same line a committee is now working on the subject of uniform specifications, and will undoubtedly report a draft of such a specification at the next meeting.

The question of labor, which is of course important to any organization composed of parties interested in the building trade, has been carefully considered by a standing committee appointed by the association for this purpose. This committee has collected a great deal of data on the subject, which is available for the use of the members at any time.

In addition to these and similar activities, the ability to obtain information and assistance from all sections of the country is of great benefit to members of the National Association.

The question of buying and selling material is one that is always important to a business organization, and a standing committee to consider this subject was one of the first committees appointed by the association. From the start the organization has felt that the proper regulation of buying and selling conditions could only be accomplished through concerted action by the manufacturers, jobbers and retailers, or in the electrical business, the contractors. The association is working along these lines and believes that eventually a condition will prevail that will be satisfactory to all parties interested in the electrical industry.

Believing that improvement always results from co-operation in any line of business, the organization has a special committee which is a part of the Co-operative Electrical Development Association, and it is believed that co-operation with this organization will result in benefits to the contractor, as well as to the electrical business in general.

In connection with the work of the National Association, a publication was started in 1901 called *The National Electrical Contractor*. This paper is devoted entirely to the interests of the electrical contracting business, and its columns are open for the discussion of any question that is of interest to the trade. Much good has been accomplished through this medium, giving

the contractor, as it does, an opportunity for the exchange of information, not only with members of the association, but with practically all of the contractors throughout the country.

It seems an almost self-evident fact that under existing business conditions, organization is necessary in every line of trade, and that, considering the broad lines on which the National Electrical Contractors' Association was formed and the extremely moderate fees for membership, the organization should be supported by every reputable contractor in the country who is interested in the advancement of the business. The secretarial offices of the association are at 94 Genesee Street, Utica, N. Y.

New Telephone Patents.

REPEATERS AND CIRCUITS.

The telephone repeater is still attracting the attention of inventors, and we have at hand for consideration two patents bearing on this subject.

Mr. C. W. Underwood, of Crowley, La., has obtained a patent for improvements on his repeater which was noted in connection with earlier patents. The novelty of this repeater lies in the fact that the moving system of the double receiver is supported upon a spider of fine metallic wires drawn up under longitudinal tension, with the result that the whole system is in a state of most sensitive mechanical balance. In the improved form each receiver magnet is confronted with a small armature, each armature being supported by its own fine wire spider in parallel planes with their center lines coincident. The transmitter button is located midway between the two receiver armatures, the plane of its electrodes being parallel to those of the spiders. An extension from each receiver armature attaches directly to the transmitter button upon that side of the latter opposite from itself; that is, a pull exerted upon both of the receiver armatures will result in a compression of the transmitter button.

WATER-PROOF TELEPHONE SET.

A water-proof hand telephone set has been patented by G. F. Atwood, of East Orange, N. J., the patent being assigned to the Western Electric Company. In this telephone, as is usual with those of the hand microphone type, the receiver is carried at the upper end of a handle and the transmitter at the lower end. The controlling switch, which is within the handle, is operated by means of a loose bar, adapted to come within the grasp of the hand of the user. In order to make the set water-proof, the transmitter at the base of the mouthpiece is provided with a water-proof diaphragm, the opening in the handle beneath the switch block is closed by a flexible water-proof diaphragm, and the cord entering the base of the transmitter passes through a water-tight stuffing box. The receiver cap aperture is composed of a number of small holes, and affords protection for the diaphragm; the edge of the cap is provided with the drainage holes which pass into the air space in front of the diaphragm near its edge, so that any moisture entering the receiver may run out through the drainage holes.

Letters to the Editors.

Central Station Accounting.

To the Editors of Electrical World:

Sirs:—I have read with much interest the discussion in your columns on the subject of a uniform system of accounting for central stations. My experience in this business has been gained only with a small company, The Deposit Electric Company, and a limited amount of observation of other small companies. In the following consideration of the subject I present what, in my opinion, is the point of view of the small companies and my object is to make a plea for great simplicity.

Mr. Stevens, at the hearing on June 24, stated that the commission was working on a simple classification for the small companies. I have great faith in Mr. Stevens and the entire commission, but there seems to be ample opportunity for a considerable difference of opinion as to what would be a simple system, as to what would be fair, and as to what details are necessary.

In general, it would seem to me that only through simplicity can there be obtained a practical uniform system of accounts. I am absolutely opposed to any form of accounting which requires any considerable use of "estimates" or "arbitrary rules" in distributing receipts and expenses. A complicated system introduces the "personal equation," and too much "personal equation" would give uniformity only in appearance, uniformity only in bookkeeping.

The commission may be of great ultimate benefit to the small companies and the communities which they serve by adopting a classification which the small companies can handle and which will be ample for their needs. I do not believe that a very large proportion of the small companies use a proper system of accounting for successful operation. However, a proper system for a small company must not only be simple, but just as simple as possible for the reasons, among others, that competent accountants are not available in rural districts; the small companies do not need a refinement of detail; they cannot afford to keep an elaborate system, and even if they could get competent accountants and could afford to go into great detail, the results would be of little or no value.

In Circular No. 45 the commission makes "bad debts" a charge against the assets. In my opinion, "bad debts" should be charged to the income as an operating expense. I think it is general practice in most businesses to allow for "bad debts" in figuring costs and profits.

The merchandise business I would handle entirely differently than is proposed in the same circular. In the small companies the merchandise and jobbing is a much larger proportion of the aggregate business than in the larger companies. I would keep the merchandise entirely separate from the "materials and supplies," keeping two stock accounts, "Merchandise" and "Materials and Supplies." The profit or loss on the merchandise I would determine from the inventories at the beginning and the end of each year, the amount of moneys received and expended for merchandise each year, and the bills receivable for merchandise at the beginning and end of each year. Then this profit or loss would be an income or an operating expense for the year. This would cut out two accounts proposed, "Electric Jobbing" and "Profit on Sales of Electric Appliances." These two accounts are confusing to me, and I think they will always be confusing, as they seem to admit of various personal interpretations. Furthermore, the account "Profit on Sales of Electric Appliances" is only the "virtual" profit and not the actual profit. Even when a company sells "wiring at cost" it does not necessarily mean that they sell at actual manufacturers' price plus freight and carting. If they did, then this "Profit on Sales" account would be nothing, while the actual merchandise account would show a loss due to waste and deterioration.

The capital accounts I would like to have as simple as possible under three headings, as in the case of operating expenses, namely, Capital to be Used for Production, Capital for Distribution, and General Capital. In this respect, as with the operating expenses, I suggest the cutting out of Transmission accounts. My company runs a 6600-volt line 11 miles to Hancock. I cannot see from an accounting standpoint or an operating standpoint why this "transmission" line should be considered separately from our Hancock distribution lines.

The following list of operating expenses which I have developed by combining accounts in Circular No. 45, are all that seem necessary for companies of a gross under $50,000, although some companies might want to keep separate accounts for Consumption and Office expenses.

PRODUCTION.

Station labor.
Fuel for steam.
Fuel for gas engines.
Fuel for oil engines.
Purchased water for power.

Lubricants.
Other station supplies and expense.
Station structure repairs.
Steam equipment repairs.
Hydraulic equipment repairs.
Gas power repairs.
Electric equipment repairs.
Purchased power.

DISTRIBUTION, INCLUDING TRANSMISSION.

Distribution labor.
Distribution supplies and expenses.
Distribution repairs.

GENERAL.

Legal expense.
General labor.
General supplies and expense.
General repairs.
Casualties.

MUNICIPAL.

Municipal consumption labor.
Municipal consumption supplies and expense.
Municipal consumption repairs.

AMORTIZATION AVERAGE.

BY-PRODUCTS EXPENSE.

INSURANCE.

TAXES.

BAD DEBTS CHARGED OFF.

Under this list of accounts my company would have to keep 32 operating accounts. We would be obliged to keep two sets of Distribution and Municipal accounts, as we serve two towns.

DEPOSIT, N. Y. MORRIS KNAPP,
Secretary and Manager, Deposit Electric Company.

To the Editors of Electrical World:

SIRS:—At a recent hearing in New York on the subject of accounting, Commissioner Stevens stated that, in his opinion, there are many smaller companies in the State which would be much better off if they kept more detailed accounts than they do at present. Although admitting the truth of this statement, it does not follow that these companies could, without very great hardship, institute and keep during the coming year a system of accounts which would be complete and proper for companies of their size. They would have to work up to such a system gradually.

There are many electric companies in this State which only keep five or six operating expense accounts, and to suddenly jump the number of required accounts to even 20 or 30 would certainly be imposing a very severe burden. The men doing the "accounting" for the small companies are not professional accountants, and in the majority of cases know very little about accounting, either theoretically or practically. They will have to be educated in this line, and it would not be reasonable to give them as their first lesson the maximum task which they will be required to do. It therefore seems to me that the policy of the commissions should be to order at the present time a very much simpler classification of accounts than will be eventually required, and to then amplify the system from time to time after the companies have become acquainted with the principles involved.

It might be found possible, after this simple classification had been in use for a short time, to work out some method of subdivision of accounts along the lines suggested by Mr. S. R. Bradley at the New York hearing. That is, the number of subdivisions of a primary account should be based not on the size of the company, but on the relative importance of the particular account and of each subdivision in question.

The action of the ELECTRICAL WORLD in opening its columns to a discussion of this subject is, I think, appreciated by the lighting men in this State, and many will doubtless avail themselves of the privilege thus afforded of expressing their opinions or describing the peculiar conditions under which they are operating.

Little has, so far, been heard in regard to the proposed classification of capital accounts, and I sincerely hope that this phase of the question will be discussed in your columns by those familiar with, and interested in, the financing of public service enterprises as well as by the operating managers and accountants.

NEW YORK. CHARLES H. B. CHAPIN,
Secretary Empire State Gas and Electric Association.

Transformer Losses.

To the Editors of Electrical World:

SIRS:—Much space has been given lately by the technical press to the apparent advantages of the new magnetic steels when used as transformer cores. Tables giving exceedingly low iron losses now being distributed show a reduction in iron losses of approximately 20 per cent. On the other hand, however, the exciting currents have reached higher points and in some cases which the writer has seen the values are almost beyond belief. The reduction of true watts iron loss and increase of exciting current have reduced the open-circuit power factor to a ridiculously low figure, sometimes as low as 5 per cent.

A central station manager will compare competitive induction motors in order to obtain the one with the best power factor both at full and light loads and this equipment is used only 8 or 10 hours per day, and yet he will use on his lighting lines transformers with low open-circuit power factor, not for 8 or 10 hours per day, but for 20 hours; the new steel is making this condition worse and not better.

Assume, for example, a generator that is rated at 100 kw-amp at 100 per cent power factor and let it supply energy to a circuit consuming 10 kw at 10 per cent power factor; the machine is running at only one-tenth of its apparent load and yet will have its full-load current and temperature in the armature windings and a far higher temperature in the field coils due to the over-excitation required to maintain the voltage at the low power factor. The writer has seen generators with the field core laminations so hot that the machine could not be run for more than four hours at a time, and yet they would cool off as soon as the lighting load came on, after 6 p. m.

The main point is being overlooked when only the true watts of iron loss are considered in buying transformers. The open circuit current is just as important if not more so. Low true watts iron loss is desirable, but only when the exciting current is proportionally low. There is an economical relationship between the length and diameter of the core, another between the copper and iron losses. There should be another economical relationship between the true watts and the apparent watt losses. The low power-factor on open circuit is turning coal into ashes with no income to compensate for it, and I claim that the new steel is not economical, and will not be on account of the high exciting current required when it is used.

During some tests being made recently between the new steel and the old steel the writer's endeavor to measure the exciting current was opposed because a manufacturer did not want to let it be known that the exciting current had reached the 25 per cent figure. It is time that some value other than true watts iron loss were considered, because this is not the vital point.

PITTSBURG, PA. L. A. STARRETT.

[If the only requirement in transformer performance were low core loss, then the old "Hedgehog" transformer with its open magnetic circuit would be in common use at the present time. However, contrary to the intimation of Mr. Starrett, it is not essential for the open-circuit power factor of a transformer to be high; it is desirable merely for the no-load exciting current to represent a relatively small fraction of the full-load current of the transformer. With a certain value of exciting current, it is far preferable for its power factor to be low rather than high. Moreover, it is permissible to increase the wattless component of the no-load current by at least 300 per cent over the value which existed in the older types of

transformers if simultaneously with this increase there is obtained a decrease of 20 per cent in the power component of the no-load current. The open-circuit power-factor in the former case might be, say, 70 per cent and only 20 per cent in the latter case, yet in neither case is the no-load current excessive in value.—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Alternating-Current Commutator-Motors.—R. Goldschmidt.—The first part of an illustrated mathematical article in which the author discusses the theory of the single-phase commutator-motor. The production of the field is first considered, and then the shunt and series methods of excitation; it is shown that the simple shunt is an impossible method. The characteristics of the ideal series-motor are then given in some detail, after which the complications and difficulties encountered in the real motor are to be considered, including commutation and the circulating currents in the short-circuited coils. Finally, the various losses are to be considered.—Lond *Elec.*, July 31.

Parallel Operation of Three-phase Alternators.—O. Weisshaar.—Continuation and conclusion of his article on the operations of three-phase alternators in parallel. The author applies his theory to practical cases and then gives a review of the different causes which may result in bad parallel operation, with their remedies. He finally discusses the design of new machines for parallel connection.—*Elek. u. Masch.*, July 12 and 19.

Parallel-Connection of Alternators.—R. F. Howard.—Some notes referring to a case in which a turbo-generator was easily connected in parallel with an existing station by means of a temporary switchboard. Another case is discussed in which heavy cross-currents were experienced during parallel-connection on account of a faulty connection of the synchronizer to the generator.—*Elec. Jour.*, August.

Lamps and Lighting.

Metallic-Filament Lamps.—W. Wedding.—A long paper giving a full account of tests of a large number of graphitized-carbon lamps, tantalum lamps and tungsten lamps. A total of 206 lamps were tested. The following table gives some of the results obtained with graphitized-carbon lamps, and with tantalum lamps. Lamps of three different sizes of each of these two types were tested. The figures given under conversion

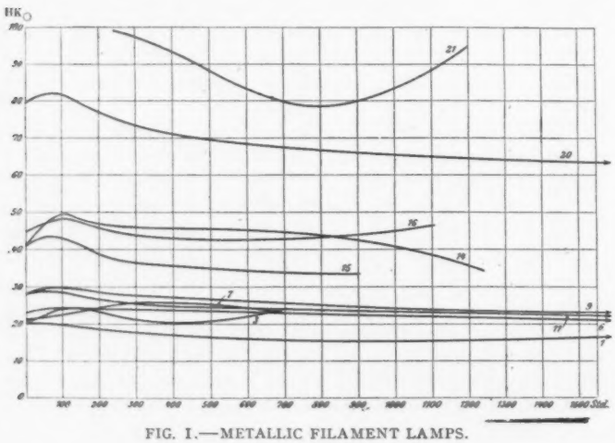


FIG. 1.—METALLIC FILAMENT LAMPS.

factor are the ratio of the initial horizontal candle-power to the initial spherical candle-power. In this table cp means always hefner candle.

With respect to the conversion factor, the tungsten lamps tested differ very much, the ratio varying between 1.197 and 1.549. The tungsten lamps also vary greatly with respect to specific consumption, namely, between 0.97 and 1.60 watts per horizontal hefner candle-power and between 1.30 and 2.31 watts per spherical hefner candle. These figures refer to the initial

Initial horizontal cp.	Conversion factor.	Initial specific consumption—watts per hor. cp.	Initial specific consumption—watts per spher. cp.	Mean specific consumption during life, watts per spher. cp.
Graphitized carbon:				
16.8	1.257	2.09	2.63	2.85
24.3	1.365	2.26	3.09	3.18
52.9	1.31	1.95	2.56	2.66
Tantalum:				
15.1	1.300	1.73	2.26	2.09
23.1	1.315	1.72	2.26	2.27
51.0	1.330	1.69	2.26	2.2

candle-power, while for the mean candle-power during life the specific consumption varies between 1.23 and 2.10 watts per spherical candle-power. Characteristic curves of the variation of the candle-power during life, for tungsten lamps of different candle-power, are given in Fig. 1. In comparing incandescent lamps with gas lamps, the author emphasizes the hygienic advantages of electric lamps for indoor lighting, while for outdoor lighting and also for the lighting of larger plants the cost of attendance and maintenance becomes of decisive importance. In this respect electric lamps are also superior to gas lamps. The author thinks that the manufacturers should endeavor to make a good 220-volt lamp.—*Elek. Zeit.*, July 30.

Generation, Transmission and Distribution.

Induction Motors.—A. M. Dudley.—A discussion of the characteristics of the induction motor in their relation to industrial applications. The author first discusses the characteristic curves, namely, the no-load running magnetization or excitation curves, the locked magnetization or stationary impedance curves; the power or brake curves, and the speed-torque curves. Typical applications of the induction motors are discussed under the following headings: Squirrel-cage motors for constant-speed service; squirrel-cage variable-speed motors; constant-speed motors with coil-wound secondaries; and motors with coil-wound secondaries for variable-speed service.—*Elec. Jour.*, July.

Traction.

Two Thousand-Volt Direct-Current Generators.—A note of the Siemens-Schubert Company with respect to the use of high-tension direct-current generators for traction. At Maizières there was a temporary suspension of work at the railway, but this was not due to any troubles with the generators. The electric work at 2000 volts had been suspended for some time on the Maizières-Ste. Marie Railway, because the electric power available was required by the rolling mills of the Rombach iron works. This deficiency has been made up by increasing the equipment of the power station and the Maizières electric railway has been working without any trouble since then. The attendance on the 2000-volt generators is no more dangerous than on 500-volt machines. The insulation of the brush holders and of the other parts of the generators which need attention is sufficient to prevent any injury to the attendants. Moreover, no attendance is required by the machine during operation, as it runs without sparking under all loads. These generators, as well as the locomotives, have proved to work as safely as machines for ordinary voltages.—*Elec. Railway Jour.*, Aug. 8.

Selection of Car Equipment.—F. E. Wynne.—An article illustrated by diagrams, in which the author discusses the proper selection of car equipment, by considering consecutively

the physical characteristics of the road; car types, weights and dimensions, and conditions of operation.—*Elec. Jour.*, August.

Installations, Systems and Appliances.

Diversity Factors.—F. FERNIE.—The diversity factor among a number of consumers is defined as that number by which the sum of the consumer's maximum loads must be divided in order that this sum may equal the maximum observed load on the station. The cost to the station of supplying energy to any one consumer is, according to the "maximum demand" system,

$$C = \frac{ak}{D} + b + XR,$$

where $a =$ that part of the capital charges per kilowatt which depends on station maximum demand, k the maximum demand of consumer, D the general diversity factor, b that part of capital charges per consumer which depends on the number of consumers, X the number of kw-hours used, and R the running cost per kw-hour. The author then divides the consumers into groups each consisting of a similar class with an approximately uniform load factor. The consumers of one class may be supplied with energy at a similar cost per kw-hour. For any station there is a certain consumer's load factor above which the cost per kw-hour alters very slowly; that is, if cost per kw-hour, as calculated from the above equation, be plotted against consumer's load factor, the rate of change of the curve is very large for low load factors, but becomes smaller and smaller as the load factor increases, approaching the value R. Hence a group of high-load-factor consumers may vary a good deal among themselves and still be charged at a uniform rate per kw-hour without any great error. The author gives a formula for calculating these factors and cites a numerical example. The following table gives some average consumer's load factors collected from different sources, all for comparatively small installations, less than 25 hp. The load factor is defined as 100 times the ratio of kw-hours per year to 8760 times the maximum demand:

Private house (lighting alone)	15 to 20 per cent
Elevators	4 "
Butchers and bakers (one motor)	3.25 to 5 "
Printers (more than one motor)	8 to 10 "
Joiners (more than one motor)	9 "
Engineers' shops (more than one motor)	12 "
Laundries (one or more motors)	12 "
Cloth workers (one or more motors)	12 "
Organ motors (one motor)	3.5 "
Stable motors (one motor)	3.5 "
Shops (lighting) (one hour average daily use of light)	5 "
Shops (lighting) (two hours average daily use of light)	9 "

—Lond. *Elec.*, July 24.

Wires, Wiring and Conduits.

Cylindrical Reinforced-Concrete Poles.—An illustrated description of the machine of H. Siegwart for the manufacture of cylindrical reinforced-concrete poles not exceeding 40 ft. in length. A taper is given to the pole. By means of the machine, pipes up to 20 ft. long and 2 ft. in diameter may also be made. Poles are especially made for tramway lines and for transmission lines, and it is claimed that the cost of erection and maintenance of these poles is less than one-half of that of steel or wooden poles.—Lond. *Elec.*, July 31.

Electrophysics and Magnetism.

Emission of Electricity and Radioactivity.—W. DUANE.—An account of an experimental investigation of the emission of electricity from the induced activity of radium. A piece of metal made radioactive by immersion in radium emanation emits considerable quantities of negative electricity; and the rate of discharge decays with the time in such a way as to indicate that radium *B* when changing into *C* discharges as much electricity as does radium *C* when changing into *D*. A magnetic field parallel to the active surface stops part of the emission of electricity; and an electric field normal to the surface also alters the rate of discharge, the magnitude of the electric and magnetic effects being about what would be expected if the charge was carried by electrons, a considerable portion of which had component velocities normal to the active surface in the neightborhood of, or less than, 4×10^8 cm per second. The number of ions produced by the α rays in air is less than 9000 times, and probably less than 3600 times, the number of β particles expelled from the wire during the same time. Assuming that each α particle from radium *C* can produce 180,000 ions, this means that for every α particle expelled from radium *C*, at least 20, and probably more than 50, electrons are emitted from an active brass surface. The number of ions produced by radium *B* in the air at atmospheric pressure close to—that is, within ½ mm of—the active surface is comparable with the number of ions produced in the same space by radium *C*.—*Amer. Jour. of Science*, July.

Radiations.—A. S. Eve gives an account of experiments on the secondary γ rays, due to the γ rays of radium *C*. He finds that the secondary γ rays, due to the primary γ rays, using lead, iron, or brick as secondary radiators, are absorbed to a degree approximating that of the primary rays of actinium. It would be interesting to examine the secondary rays due to the primary rays of actinium. These would probably be absorbed even more readily, and would approximate more closely to the X-rays. H. L. Bronson discusses the relative activity of the emanation and the active deposit from thorium and from actinium. Many important calculations in radioactivity are based on the assumption that each atom of the various radioactive bodies, at each transformation, gives off either one or no α particles. This appears to be true for radium and its transformation products, but has been found by Boltwood not to hold true for thorium. Boltwood's results are confirmed by Bronson, who also finds that the above rule does not hold good for actinium. It therefore follows that the number of α particles given off when an atom of any radioactive surface breaks up is not the same for every active substance. E. Rutherford has measured the volume of the radium emanation at normal pressure and temperature and finds the result in fairly good agreement with calculated values. E. Rutherford and T. Royds have determined the spectrum of the radium emanation.—*Phil. Mag.*, August.

Singing Arc.—M. LA ROSA.—A singing arc may be obtained not only under Duddell's conditions, but also when the shunt circuit across the terminals of the arc has no proper period, so long as it has a high capacity. However, the phenomena obtained in the two cases differ notably in certain details. The essential difference is in the light emitted by the arc. On examining in the spectroscope the light emitted by the singing arc, using only a condenser, a spectrum is obtained differing from that obtained with the ordinary singing arc or with the continuous arc. If the capacity of the condenser is sufficiently great, and if the inductance of the conductor joining its two armatures to the poles of the arc is the lowest possible, the spectrum emitted is a line spectrum, and resembles the spectrum of the dense spark between carbon terminals. If the oscillations nearly cease, as happens from time to time, or if their amplitude diminishes, the line spectrum abruptly disappears, and is replaced by the well-known band spectrum of the arc. The transformation of the spectrum under changing electrical conditions is discussed.—*Atti dei Lincei*, translated in Lond. *Elec.*, July 31.

Short-Spark Phenomena.—W. DUDDELL.—His British Physical Society paper in full on some curious observations with induction coils, noticed already in the Digest.—*Phil. Mag.*, August.

Minimum Spark Potentials.—J. E. ALMY.—Several recent investigators have found in experiments with very short spark-gaps that a spark discharge can occur at potentials far below the so-called minimum spark potential. The author thinks it probable that there is an error in these investigations because the potential measured was not the potential producing the disruptive discharge through the gas; this potential was sufficient to produce an electrostatic attraction between the electrodes which were very near together so that they came actually into contact.—*Phys. Zeit.*, Aug. 1.

Fog Chamber.—C. BARUS.—A note on the standardization of the fog chamber by the aid of Thomson's electrone. This he considers to be the most promising method for evaluating the coronas in terms of the number of nuclei which they represent

under given conditions of exhaustion.—*Amer. Journ. of Science*, July.

Production of Ions.—E. W. B. Gill and F. B. Pidduck.—An account of experiments in verification of the theory of the genesis of ions by collision of positive and negative ions in gases, conducted on the monatomic gases, argon and helium.—*Phil. Mag.*, August.

Liquefaction of Helium.—According to K. Onnes the boiling point of helium is 4.3 deg. C. abs. and the gas was not solid when exhausted to 10 mm of mercury, at which pressure the temperature must have been about 3 deg. C. abs.—Lond. *Elec.*, July 24.

Alternating-Current Diagrams.—C. Richter.—A note on the different methods for representing alternating-current phenomena by means of diagrams. The author urges uniformity of notation, for instance, with respect to the direction of rotation of vectors.—*Elek. u. Masch.*, July 12.

Units, Measurements and Instruments.

Definitions and Constants.—A proposal of the Committee on Units and Formulas of the German Association of Electrical Engineers. Definitions are given of potential, potential difference, e.m.f., tension (spanning) and tension difference with explanatory notes by H. Georges and H. Rubens. For conductance (Leitwert, the reciprocal of resistance) the unit in the practical electromagnetic system of units is called siemens, the symbol being *S*. The reciprocal of the specific resistance is conductivity (Leitfähigkeit) or specific conductance (spezifischer Leitwert). Explanatory notes on this proposition are given by J. Teichmüller and M. Wien. (The units Siemens would, therefore, be exactly the same as our mho; the latter is objected to by the Germans because it is a "mutilation" of the name ohm). Finally the value of the mechanical equivalent of heat is proposed to be standardized as follows, explanatory notes being given by K. Scheel and R. Luther. The equivalent of the 15 deg. calorie (that is the calorie referring to the temperature difference from 14½ to 15½ deg. C.) is 4.189×10^7 ergs. The mean calorie between 0 deg. and 100 deg. C. is equal to the 15 deg. calorie. The constant R in the gas law has the value 0.8316×10^8, if the erg is taken as the unit of energy, and the value 1.985, if the gramcalorie is taken as the unit of energy. The value of the constant in Joule's law is 0.2387.—*Elek. Zeit.*, July 30.

Symbols for Physical Quantities.—C. C. Garrard thinks that the proposition of Miles Walker (recently published in Electrical World) is too ingenious to be practical, because too large a number of new symbols would be required. For instance, the number of symbols required for all kinds of temperature in different scales would be very large. "Progress is most likely to be made if we follow the Esperanto method and standardize symbols which would be at once recognized, say, by French, German and English readers, or, at any rate, symbols which represent the greatest common measure of such recognition on the part of the three nationalities concerned. Thus the expression $\sim$ for complete periods per second, d = diametre, durchmesser, diameter, etc., illustrate this suggestion. Miles Walker replies that his proposal is not to have a new symbol for every temperature expressed in every scale, but to have at most two symbols for temperature. One of these would replace the t or θ now commonly used. The other (a slight modification of it) might be used when the temperature was expressed in degrees centigrade. One of the advantages of having a distinct symbol for a quantity expressed in the best recognized system of units is that it would induce writers to use that system whenever possible.—Lond. *Elec.*, Aug. 7.

Electrolytic Prepayment Meters.—An illustrated description of a simple electrolytic "quarter" meter for house installations. A voltmeter filled with a caustic soda solution has one electrode permanently fixed to the side and the other suspended in the center, and is directly in series with the consumer's lamps. The passage of the current electrolyzes the solution, and lowers its level in proportion to the number of coulombs. When the level of the solution falls below the suspended electrode, the circuit is broken and the supply of electricity stopped until the suspended electrode is lowered and again immersed in the solution. The above is the principle of the meter, but a few modifications were necessary to render the meter fit for practical use. By the introduction of a third fixed electrode into the voltameter, the circuit is not broken when the level drops below the suspended electrode, but a lamp inside the meter is put in series with the consumer's lamps, thus indicating when it is necessary to lower the electrode. The insertion of a quarter allows an outside handle to be rotated when the quarter drops and the suspended electrode is lowered by a definite amount. Evaporation from the surface is prevented by a thin layer of high-flash parafine oil. The meter is constructed to take about 45 quarters before requiring to be refilled. Several quarters may be inserted at one time.—Lond. *Electrician*, July 24, and *Elec. Eng'ing*, July 23.

Capillary Electrometer.—M. G. Lloyd.—A note on the use of the capillary electrometer with alternating voltages. While with direct-current voltages the deflection-voltage curve is a parabola, it is a straight line with alternating voltages. With alternating voltages the readings, except for very small voltages, are not steady and are not reproducible. On account of this uncertainty in deflection, the electrometer could not be used for an accurate measurement of alternating voltage. However, as a detector of alternating voltages, it would be perfectly feasible to use the electrometer. The sensibility, however, is very much smaller for alternating current than for direct current on the same instrument. The same issue contains a theoretical note by the same author on the "function of a periodic variable given by the steady reading of an instrument."—*Bull. Bureau of Standards*, Vol. IV, No. 4.

Localizing Breaks in Cables.—J. Rymer-Jones.—The first part of an article in which the author describes his test for localizing high-resistance breaks in cables. This test includes a measurement of the cable circuit resistance; of the charge taken up by the cable portion; of the cable current, as well as the constants required for resistance and capacity. All of these are made with a galvanometer connected up in the ordinary way, with the sole exception of the charge measurement, for which there is employed a galvanometer having its coils equally divided, so that each half of the turns exercises an opposite influence on the suspension when connected up in parallel circuits to act differentially. The article is to be continued.—Lond. *Elec. Rev.*, July 24.

Phase Difference.—M. Miet.—An illustrated description of a method of measuring directly by means of a wattmeter the phase difference in a balanced three-phase system, without making use of the neutral point. Three readings are necessary.—*L'Industrie Elec.*, July 25.

Selenium Cell.—W. S. Gripenberg.—In the manufacture of selenium cells it is necessary to put a thin selenium layer on a solid body. The author finds that this is best done by condensing selenium vapor on a cold surface. Layers of very small thickness are thereby obtained which are at the same time quite uniform. A selenium layer deposited on glass in this way is quite adhesive.—*Phys. Zeit.*, Aug. 1.

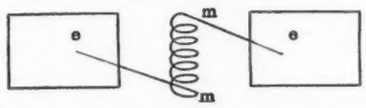
Switchboard Apparatus.—An illustrated description of various switchboard apparatus exhibited by Maljournal and Bourron, of Lyons, at present international electrical exhibition in Marseilles.—*L'Industrie Elec.*, July 25.

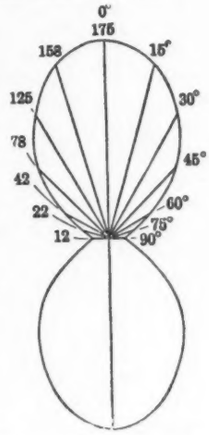
Telegraphy, Telephony and Signals.

Directive Wireless Telegraphy.—An article on an arrangement of F. Kiebitz for sending electromagnetic waves in a certain direction. The directed electromagnetic waves are excited by giving the radiating system such a shape that although each electric and magnetic line system generated in space has an axis of symmetry, the two axes are in this case perpendicular or make an acute angle, while at the same time the direction of the electric force is inclined to that of the magnetic force. In this case the plane of greatest magnetic force is inclined to the plane of greatest electric force, the line bisecting the enclosed angle being the direction of greatest energy emission. The contraction of the receiver is based on the same principle. The arrangement shown in Fig. 2 consists of a solenoid whose

ends *m m* are connected to two metal surfaces *e e*. When such a system is excited, inductively, the electromagnetic field which is set up consists of that of a magnetic doublet oscillating in the direction *m m*, and an electric doublet oscillating between *e e*. The electromagnetic field thus has a minimum in the plane of the paper and a maximum at right angles to this. Nothing is changed if the whole arrangement is turned in its plane through 90 deg., and one of the metal plates is replaced by the earth. The results obtained with this arrangement are shown in the energy diagram of Fig. 3. On turning the transmitter round a vertical axis the readings at the receiver (in the laboratory) were as shown in the figures at the left side of the energy diagram, the figures on the right-hand side indicating the angle through which the transmitter had been turned from its position of maximum energy radiation.—Lond. *Elec.*, July 31.

Thermoelectric Detectors.—C. TISSOT.—In connection with the use of crystalline contacts for electromagnetic wave detectors the author states that almost any two substances may form a detecting combination without any outside source of e.m.f. The only requisite is that the area of contact should be very small. The further apart in the thermoelectric series the bodies are situated, the better is the effect; this indicates that the effect is really of purely thermoelectric nature. Such substances as pyrites and manganese dioxide in the form of pyrolusite may be associated with any pure metal, the latter being strongly electropositive with respect to those minerals. On the other hand, the natural sulphide of copper (chalcasine), as well as the fused artificial sulphide, or selenium and tellurium, are strongly electronegative toward metals. If the contact has a high resistance, the detector must be placed at a ventral segment of tension of the receiving system. If low, at a ventral segment of current. A copper point pressed against copper pyrites is just as effective as a point pressed against tellurium. The observation is made with the telephone.—Lond. *Elec. Eng'ing*, July 23.





FIGS. 2 AND 3.—DIRECTIVE WIRELESS TELEGRAPH.

Electric Recording Target.—An illustrated description of the Rose system of electrical recording at a distance the exact position of a bullet hole.—Lond. *Elec. Rev.*, July 30.

Wireless Telegraphy.—An illustrated article on Poulsen's method of wireless telegraphy and telephony.—*L'Industrie Elec.*, July 25.

Miscellaneous.

Special Steels for Electrical Purposes.—E. WILSON, V. H. WINSON AND G. F. O'DELL.—An account of an investigation into the hysteresis and other magnetic properties of two special iron alloys invented by R. A. Hadfield. One is the alloy called "stalloy" (which contains about 3 per cent of silicon), and the other is a transformer steel called "lohys." The specimens were in the form of rings built up of stampings, and were wound over with primary and secondary coils for the ballistic method of testing. The alloys are found to differ considerably from pure iron in their magnetic nature. For instance, it is well known, from Rayleigh's work, that for Swedish iron the permeability is very nearly constant for all flux values between 0.00004 and 0.04 c.g.s. In the case of both these alloys the value of μ rises rather quickly in the range of field values just mentioned. Stalloy is somewhat remarkable in that it very readily yields unsymmetrical hysteresis loops. For example, as an extreme case, the flux was reduced from 63 to 0.712 c.g.s. units, and a loop obtained with the latter figure as the maximum H. If, in the unsymmetrical loop thus drawn, the axis of H is placed so that the coercive forces are equal, the positive and negative values of B remain very unequal, though the positive and negative values of the residual magnetism are equal. This effect persisted after some hundreds of reversals, and was removed only by reapplying the larger force and reducing the field slowly through many reversals. The Steinmetz coefficients for both materials are worked out from the usual definition, but vary through a wide range in the materials.—*Proceedings Royal Soc'y*, June; abstracted in Lond. *Elec. Eng'ing*, July 23.

NEW APPARATUS AND APPLIANCES

Switchboard for the Salt River Reclamation Plant.

The Salt River project of the United States Reclamation Service is more or less familiar on account of the wide notice it has received, due to the immense size of the dam and storage basin, the latter being the largest artificial reservoir in the world, and also because the large town of Roosevelt will be wiped out of existence when the reservoir is filled. About 200,000 acres of arid land near Phoenix, Ariz., is to be irrigated by a canal system fed from the main reservoir, and it is intended to irrigate an additional 40,000 acres by underground waters, made available by the installation of pumping stations at suitable points. Two important features of the Salt River project are a 6000-kw hydro-electric power station and a 45,000-volt transmission system.

The primary object of the generating station referred to above is to provide power for the operation of the pumping plants, and it is expected that several other generating stations will be constructed at various points to provide still more power. A market for surplus power can easily be found in the towns in the Salt River Valley. A temporary plant has been in operation for some years at the Roosevelt dam to supply power for the operation of the cement mill, construction machinery, lighting of the town, etc., and some of the machines in this station are to be transferred to the new power plant. The purpose of this article is to describe the controlling board, which has recently been completed for installation in the new power station.

The alternating-current switchboard selected by the government engineers for controlling the apparatus in the main station is an excellent illustration of recent "bench" control board construction. It is of the "open" type; that is, there is a space left between the instrument sections and the control bench, so that the switchboard operator can have an unobstructed view of any part of the generator room without going to the end of the board, which is located at the edge of the gallery about 18 ft. above the main floor. This bench board is equipped for the control of the following circuits, the exciter switchboard being entirely independent and of the ordinary vertical construction:

Six 2300-volt, 1060-kw, 25-cycle, three-phase, three-wire generators.

Six 2300-volt delta—45,000-volt Y, 1060-kw, 25-cycle, three-phase banks of transformers, grounded neutral.

Two 45,000-volt, 6000-kw, three-phase outgoing lines.

Fig. 1 shows the system of connections specified by the government, one line in this diagram representing the three-phases. It will be seen that both high- and low-tension buses are in duplicate, allowing ample flexibility for operation, testing, inspection and repairs. Two electrically-operated oil switches are used in every circuit and complete control of the system is therefore obtained at the bench board. This arrangement is advantageous

where it is important that there be no shut-downs of an appreciable length of time. With more than two transmission lines it would probably have been advisable to modify the connections to allow of isolating any line for testing purposes after the automatic switch had been tripped by a short-circuit or other line trouble.

All protective relays used on this board are of the time-limit type in order to prevent shut-downs due to momentary over-

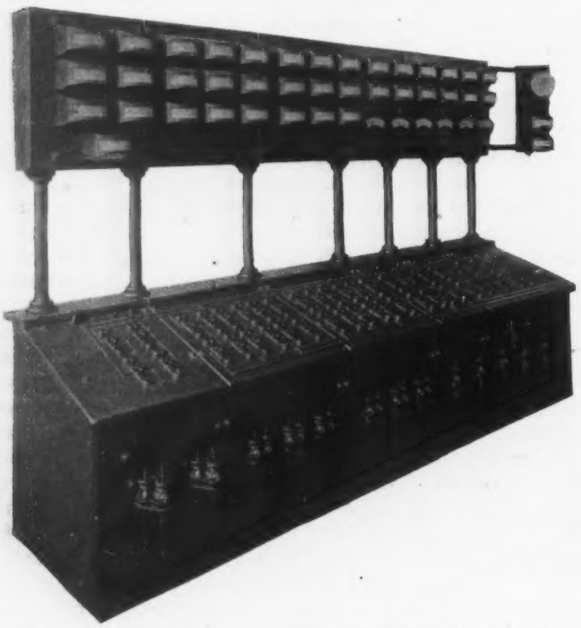


FIG. 1.—ALTERNATING- AND DIRECT-CURRENT SWITCHBOARD.

loads. The definite time-limit overload relays on the lines will, of course, be set for such a current and time that they will take care of overloads or short-circuits external to the station. Generator relays are also definite time-limit overload and will be set so that the generator switches will be tripped only on account of large exchange currents at the time of synchronizing. Inverse time-limit overload relays are used on the transformer circuits and are so connected that trouble in any transformer will automatically disconnect all the transformers, but will leave the generators operating in parallel on the low-tension bus. That the government engineers anticipate but little trouble with the transformers is evidenced by the fact that no provision is made in the transformer protective devices for selective operation. By using series inverse time-limit overload relays on the high-tension side of the transformers, in addition to the low-tension relays, only the defective bank of transformers would be disconnected in case of trouble.

The low-tension oil switches are the General Electric Company's standard type, as shown in Fig. 2, each complete switch consisting of three single-pole, single-throw elements operated by a single solenoid. The switches are mounted in fireproof cells, each pole in a separate compartment, with the solenoids in small subcells. The cell doors are made of asbestos lumber with a fireproof wooden framing and are pivoted at the top, but have no fastenings at the bottom. This light, free-swinging construction of cell doors has proved preferable to heavy doors which are fastened tightly to the cells, as the effect of explosions in the cells is temporary only so far as the door is concerned. The disconnecting switches, busbars and instrument transformers are mounted on pipe framework above the oil-switch cells. As will be seen from the diagram of connections, disconnecting switches are provided on both sides of every oil switch, so that any switch can be inspected, tested and repaired without shutting down any of the circuits.

The high-tension oil-switches are similar in construction to the low-tension switches, and are shown in Fig. 3. These switches are operated in groups of three single-pole elements by solenoids mounted on top of the switch cells. The switch is a top-connected device, but in this case the buses and disconnecting switches are necessarily located below the oil-switch cells. The adaptability of the switch to different arrangements will be appreciated when it is stated that the only change made in the ordinary layout with the buses above the switches was an increase in the size of the cells, this being necessary in order to obtain suitable striking distance from the leads to the ground. Masonry compartments are provided for the high-tension busbars.

Protection against lightning is obtained by the use of a three-phase aluminum-cell lightning arrester for each transmission line, these arresters being mounted outside of the station.

The benchboard proper consists of six panels of oiled black slate, the total height, including the instrument section, being 8 ft. 2 in., and the length, exclusive of the swinging bracket 12 ft. 7 in. Facing the switchboard, the first panel at the left controls the two outgoing lines, the next two panels each control three banks of step-up transformers and the three panels at the right-hand end control two generators each. The alternating-current voltmeters and the synchronism indicator are mounted on a swinging bracket at the right-hand end of the board. The back of the instrument sections and control bench is entirely enclosed by removable grille-work doors.

One alternating-current ammeter, one field ammeter and one polyphase indicating wattmeter are provided for each generator circuit. The two voltmeters on the swing bracket are connected to the synchronizing bus in such a way that, when synchronizing, one indicates the voltage of the starting machine and the other the voltage of the busbars to which the incoming machine is to be connected. At other times the synchronism indicator is disconnected from the synchronizing bus by means a small snap-switch mounted on the swinging bracket, and the volt-

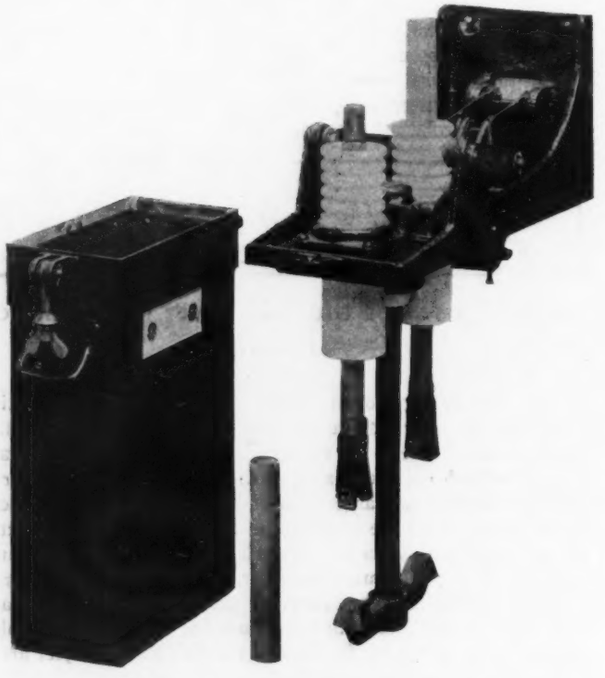


FIG. 2.—300-AMP, 15,000-VOLT OIL SWITCH.

meters can then be connected to any machine by means of the synchronizing plugs entirely independent of the synchronism indicator.

The synchronizing and control switches and the relays are mounted on the control bench. Two synchronizing receptacles are provided for each generator, one being used when synchronizing with bus No. 1, and the other when synchronizing with bus No. 2. Two sets of contacts in these switches

are used for synchronizing purposes, but the third set of contacts is connected in series with the closing side of the corresponding oil-switch control switch, so that no damage can be caused by the operator becoming excited when synchronizing and trying to close the wrong oil switch. To assist the operator in synchronizing, a governor control switch is provided for each generator circuit, this being a double-pole double-throw reversing switch connected to the governor motor.

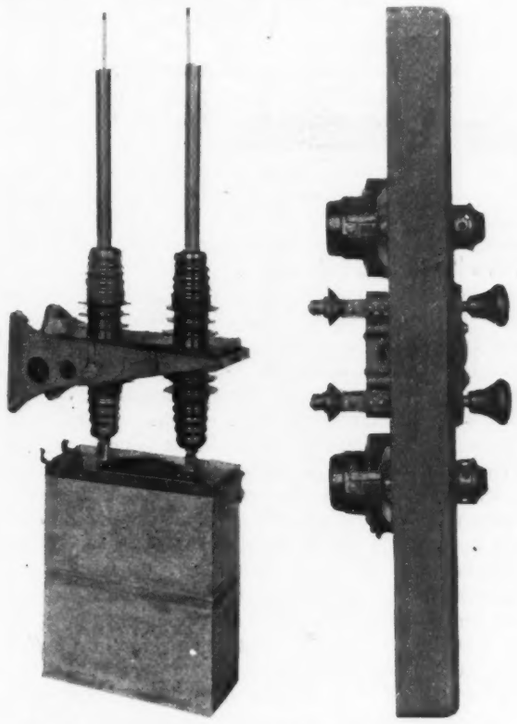


FIG. 3.—100-AMP, 45,000-VOLT OIL SWITCH. FIG. 4.—TWIN PULL BUTTON CONTROLLING SWITCH.

The controlling switches for the oil switches and field switches are the well-known twin-pull button type, as shown in Fig. 4, which also shows the indicating lamps or bull's-eyes. One button actuates the "closing" contacts and the other the "opening" contacts and they are so interlocked that it is impossible to operate both buttons together. An indicator is provided on each switch, which shows green after the control switch has been operated to open the oil switch and red after it has been operated to close it. Being a pull-button switch, it is impossible to cause trouble by accidental pressure, and as the contacts are behind the panel, there is no danger to the operator and no chance of accidental short-circuits. Severe arcs cannot occur in the control switch on account of a solenoid control relay being used to open and close the closing-coil circuit of the solenoid. The use of this relay, which is mounted close to the solenoid, makes it unnecessary to run large control leads to the benchboard. The indicating lamps are connected so that they show the actual position of the main switch, red when the oil switch is closed and green when it is open. If the indicating lamps and the switch indicator do not agree, the operator knows that the oil switch has tripped automatically. When this has occurred the control-switch indicator shows red and the indicating lamps green. To make the indicating lamps plainly visible from a considerable distance or at an angle, a V-shaped projection is cast on the front of the lens.

Generator field-rheostats are mounted below the switchboard gallery and are controlled by combination bevel gear and chain mechanisms, the operating hand-wheels being mounted on pedestals in front of the switchboard. The field switches are solenoid-operated and controlled from the benchboard, the same type of control switch and indicating lamps being used as for the oil switches. As stated above, the exciter and field-switch panels are of the ordinary vertical type, two sets of busbars being used. As the field switches are single-pole, single-throw, it is necessary to connect double-pole, double-throw lever switches in series with them so that the fields can be connected to either bus.

Mimic busbars are mounted on the control-switch bench and consist of small polished copper bars which have no electrical connection with any part of the circuit. They show the system of alternating-current connections exactly as indicated in Fig. 1, the controlling switches representing the oil switches and nameplates representing the generators, transformers and lines.

The overload relays provided for the generator circuits are single-pole, the secondaries of the current transformers being cross-connected. As the generators are three-wire machines, the third line necessarily carries the resultant current of the other two lines, and full protection is obtained by the use of two current transformers. This connection cannot be used on the transformer panels, as three ammeters are provided for the transformer circuits, and it was consequently necessary to use double-pole relays. On the middle generator panel is mounted the signal relay, which is used to ring an alarm bell when any of the oil switches are tripped automatically. This relay is arranged so that the bell continues ringing until the operator releases the relay and is connected in such a way that it does not operate when the oil switches are opened or closed by the switchboard operator.

Each transformer circuit and each line is equipped with three ammeters. In addition to these instruments there is one ammeter connected in the neutral bus so as to read ground currents. Controlling-circuit equipments are similar to those for the generator panels. Synchronizing receptacles are provided for the line circuits, but not for the transformer circuits, the receptacles for the line circuits being intended for use when additional generator stations are placed in operation.

As to the general arrangement and equipment of the board, no panel is at all crowded, the control and measuring apparatus is simple and no superfluous or infrequently used devices are included. The equipment for each circuit is segregated so that

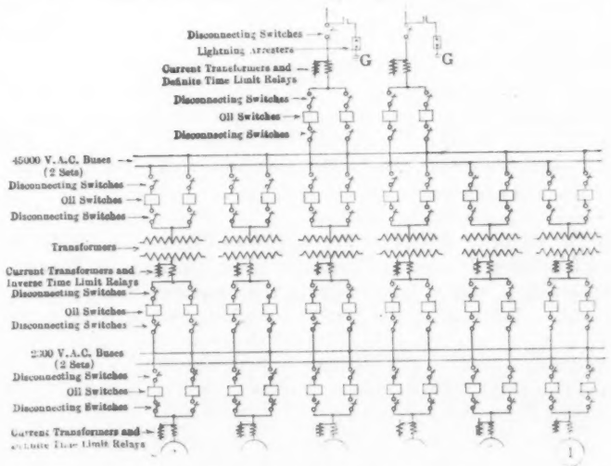


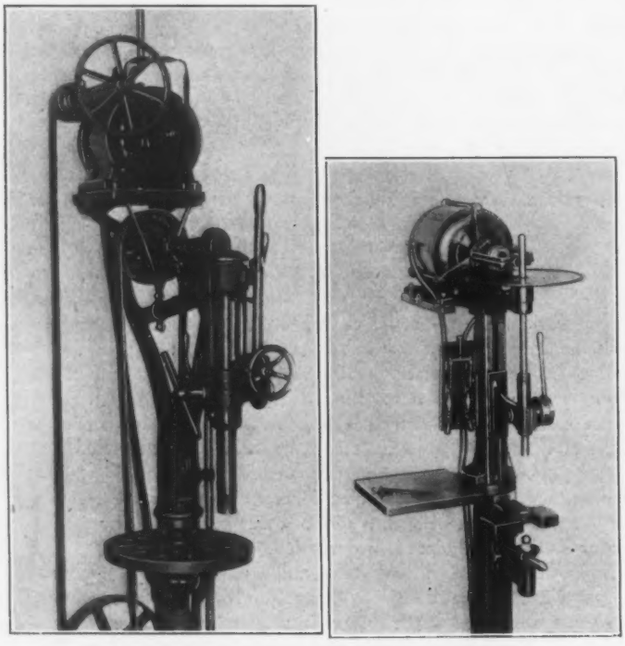
FIG. 5.—DIAGRAM OF SWITCHBOARD CONNECTIONS.

there is no confusion in emergencies. Many recent switchboards have been unnecessarily complicated and crowded on account of including elaborate testing equipments or other devices used only at long intervals of time, the designers apparently overlooking the fact that switchboards are primarily intended for constant use in controlling the machines and circuits. Simplicity in operation involves a corresponding simplicity in design and equipment, and insures reliability which, in the large majority of central stations, is of the greatest importance.

The switchboard described above was designed and built by the General Electric Company, of Schenectady, N. Y., to meet the requirements set forth in the government specifications, and has just been shipped to Arizona. The photograph was taken at the factory, and shows the board exactly as it will be installed.

Induction Motor Drive in a Manual Training School.

The Bryant High School, Long Island City, New York, is equipped with the most modern appointments for the education of boys and girls of high-school age. Manual training is a prominent feature of the school course, and is carried on by a competent staff of instructors, while the most up-to-date conditions of the various trades there taught are closely approxi-



FIGS. 1 AND 2.—MOTOR-DRIVEN DRILL PRESSES.

mated in the unusually complete equipment of machine tools and other apparatus. The appreciation of the value of the training given at the Bryant High School is evidenced by the large and increasing attendance. Thus, the registration for the school year ending June 30 was approximately 900 pupils in the day classes, about evenly divided between boys and girls, and 1100 in the night classes.

The manual-training laboratories, or shops, for instruction in the various trades that are taught to the boys, comprise a machine shop, joinery and carpenter shop, on the main floor of the building, and a forge shop in the basement. These shops contain a full equipment of modern machine tools, a large number of which are driven by Wagner single-phase induction motors, as given in the lists below and illustrated in part in the annexed views. These motors are designed for 60-cycles, 208-volt operation, receiving energy from the street service mains of the Brooklyn Edison Company; they are started and stopped by a simple double-pole switch.

The machine shop, which is equipped with 24 bench positions on two sides of the room under the windows, for "floor work," contains the following motor drives:

Planer, belted to a 3-hp, back-geared ceiling motor; small planer, belted to a 2-hp, back-geared ceiling motor; small planer, belted to a 1-hp ceiling motor with a four-step cone pulley; grindstone, belted to a 2-hp, back-geared ceiling motor; No. 2 universal milling machine, belted to a 2-hp, back-geared ceiling motor, with a four-step cone pulley; No. 1 plain milling machine, belted to a 1-hp, back-geared ceiling motor, with a four-step cone pulley; tool grinder, belted to a 3-hp ceiling motor. The motor drives a ceiling counter shaft having a five-step cone pulley, and from which the emery wheels, oil pump, etc., are driven by separate belts; grinding machine, belted to a 1-hp ceiling motor; grinding machine, belted to a ¼-hp ceiling motor; small lathe, belted to a ¼-hp, back-geared ceiling motor, with a four-step cone pulley; small lathe, belted to a ¼-hp, back geared ceiling motor, with a four-step cone pulley; cutting-off saw, belted to a ¼-hp, back-geared ceiling motor; large radial drill, belted to a 1-hp, back-geared motor, with four-step cone pulley mounted on top of tool; radial drill, belted to a ½-hp, back-geared motor, with four-step cone pulley, mounted on top of tool; sensitive drill, belted to a ¼-hp motor, mounted on tool; emery wheel, belted to a 2-hp motor, mounted on tool.

The joinery, which contains 18 lathe positions and several work benches, is equipped throughout with Wagner motor drives as follows:

Eighteen wood-working bench lathes, each belted to a ¼-hp ceiling motor, with three-step cone pulley; large grindstone, belted to a 2-hp ceiling motor; band saw, belted to a 2-hp ceiling motor.

The carpenter shop, which is equipped with work benches and pattern-making equipment, contains the following motor drives:

Circular saw, belt-driven by a 3-hp motor, and an emery wheel, belt-driven by a 2-hp motor.

The forge shop contains 12 forges, 24 anvils and 12 bench positions, and is equipped with the following motor drives:

Radial drill, direct connected to a ½-hp, back-geared motor; emery wheel, belted to a 2-hp motor.

In addition to the above Wagner single-phase motor drives, there is installed in the sub-basement of the building a triplex pump for supplying water to the roof-tank system, gear-driven by a 2-hp motor, mounted on the pump.

As above stated, each of the motors driving a machine tool is started and stopped by an ordinary double-pole switch. This switch is operated by a cord hanging within easy reach of the pupil working at the tool. The switches are mounted in out-of the-way locations—usually on the ceiling alongside the motors that they control. With the motor not running, pulling the cord closes the switch and starts the motor; another pull of the cord opens the switch, thereby stopping the motor. This extremely simple arrangement, so well adapted to the requirements of a school with its necessarily non-expert operation of the motors by the pupils under instruction, is made possible by the design of the Wagner single-phase motor with its automatic starting device, the operation of which will be clear from the following brief description.

The Wagner single-phase motor is an induction motor having a commutator connected to the rotor winding and mounted upon and rotating with the armature shaft. Bearing upon the commutator is a pair of fixed brushes connected by a short-circuiting conductor, so as to short circuit the rotor winding when the motor is standing still or running below normal speed.

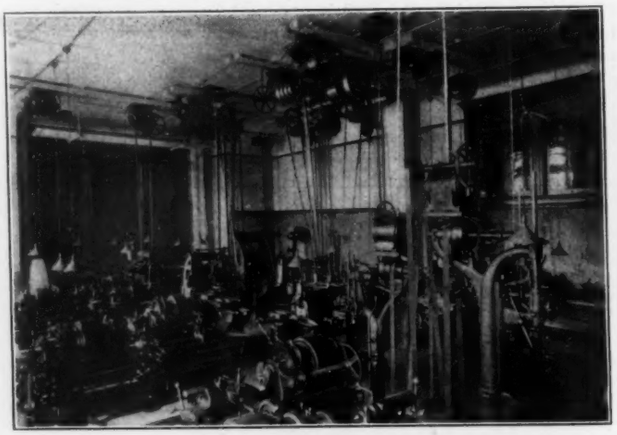


FIG. 3.—MOTOR-DRIVEN MACHINE TOOLS.

When the stator circuit is connected directly to the supply mains—in the case of the motors above referred to, by the closing of the simple cord-operated switch—the currents produced in the rotor develop a very powerful starting torque,

amounting, indeed, to 250 per cent of the normal running torque, which brings the motor quickly up to speed under load. The motor thus starts as a "repulsion" machine. On attaining nearly full speed the individual segments of the commutator are positively short-circuited, thereby transforming the rotor winding to the squirrel-cage form, and at the same instant the

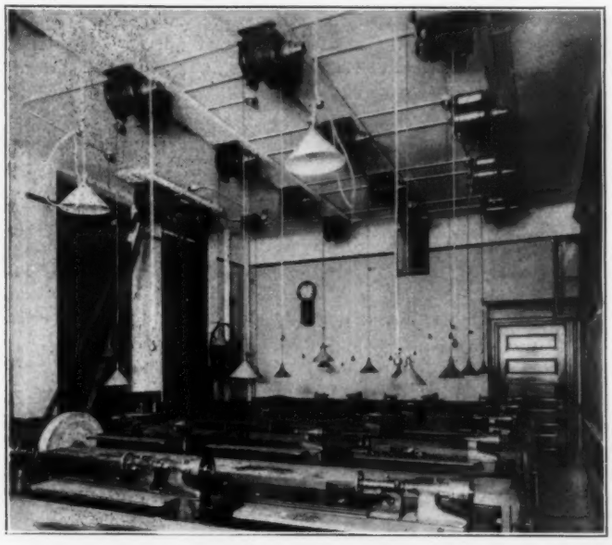


FIG. 4.—CEILING TYPE MOTORS FOR DRIVING LATHES.

brushes are removed from the surface of the commutator, whereupon the machine begins to operate as a simple induction motor; the changes being automatically performed by a simple and effective device actuated by centrifugal force.

The centrifugal device contained in the motor operates automatically, thereby avoiding any possible trouble from careless

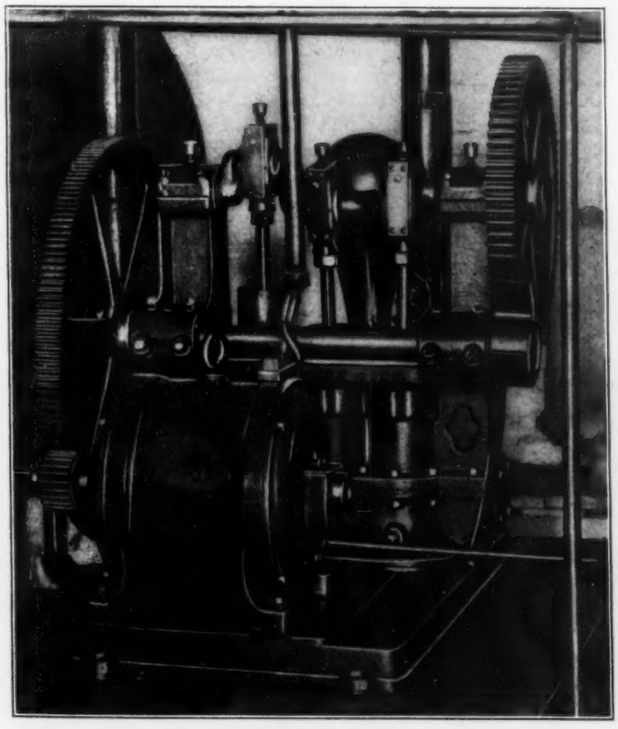


FIG. 5.—MOTOR-DRIVEN PUMPS.

handling, and is, indeed, so well worked out that the motor is practically "fool-proof." On sudden overloads the device automatically returns the motor connection to the high-torque starting position; unless such an overload is continued for a considerable time, the motor will automatically take care of it at the slower speed. Upon the removal of the overload, the motor speed will automatically return to its normal operating value.

Electric Motor for Electrical Contractors' Use.

The adaptability of electric motors to various services is well illustrated in the accompanying two views of a direct-current motor, with a circular saw on the extended shaft. The motor, which is of Westinghouse design, differs from the standard type S only in that the shaft is somewhat larger and longer on the pulley end and that a bracket is supplied on the commutator and to provide a bearing nearer the saw. The motor speed may be varied from 1125 to 1800 r.p.m. to provide for various classes of work with saws of different diameters. This motor is rated at 10 hp.

It will be noted that a pulley has been placed on the extended shaft at the commutator end. This pulley is intended to act as a flywheel and also to provide a place for a brake, controlled by means of a lever near the operator whenever it is desired to

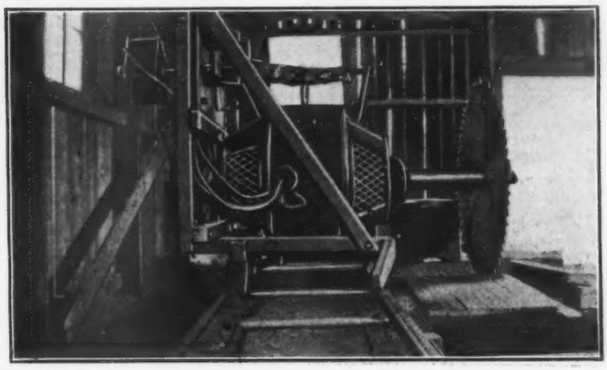


FIG 1.—CIRCULAR SAW DRIVEN BY DIRECT-CURRENT MOTOR.

stop the saw quickly. The contractor has also installed a bladed fan on the pulley to blow air over the motor and throw the chips and sawdust away from the track and the motor. These, however, cannot be seen in the illustrations.

In Fig. 1 a large circular rip saw is shown taking a cut in a heavy oak timber to be used in dam wickets on the Ohio River. Fig. 2 illustrates a groove cutter in use. A cross-cut saw is also used by the contractor who owns the outfit.

The motor is mounted on a frame with wheels, which run on a short piece of track, so that the saw may be moved toward the timber. Mounted on the frame which carries the

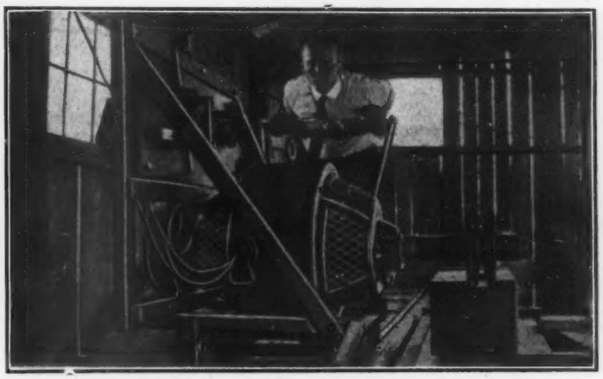


FIG. 2.—MOTOR-DRIVEN GROOVE CUTTER IN USE.

motor is the switchboard panel, with a field circuit rheostat for adjusting the speed, a starting rheostat and a circuit breaker. As the motor must move back and forth, energy is supplied through two short stretches of trolley wire on which

the trolley wheels run, similar to the method used in a traveling crane. The entire outfit is intended by the contractor for portable service, energy being obtained from a portable gas-engine-driven generator.

Motor-Driven Milling Machines.

Many direct, as well as indirect, advantages resulting from driving machine tools by electric motors have resulted in a gradual improvement in the methods of attaching the motors to the tools. In many instances the characteristics of the motors have been such that modifications could be made in the tools to such an extent that they were considerably simplified, as well as their productive capacity increased, by treating the motor and the tool as a unit in making the original designs. These applications may be contrasted favorably with the somewhat

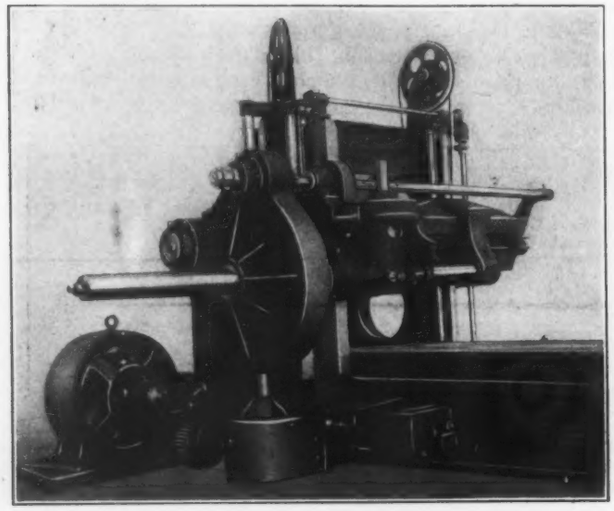


FIG. 1.—MILLING MACHINE DRIVEN BY DIRECT-CURRENT MOTOR.

older method of applying a motor to a standard belt-driven tool.

As direct-current and alternating-current motors have characteristics of different natures, the methods of applying these two types of motors are materially different. For that class of service requiring a variable cutting speed, the direct-current

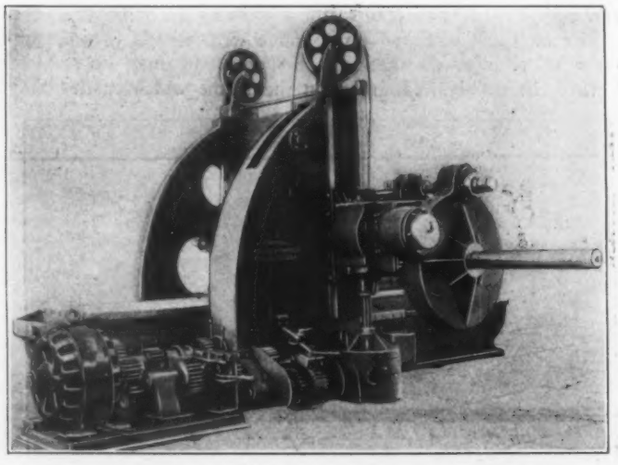


FIG. 2.—MILLING MACHINE DRIVEN BY INDUCTION MOTOR.

adjustable-speed motor is especially well adapted. A good example of this is illustrated in Fig. 1, where a 50-hp Westinghouse motor is shown applied to a heavy milling machine manufactured by the Ingersoll Milling Machine Company. The motor has a speed variation of from 500 to 1000 r.p.m., the speed being controlled by means of a drum-type controller not shown in the illustration, mounted at a point convenient to the operator.

In addition to the speed variation obtained in the motor there are change gears giving speed variations of about 7 to 35 r.p.m., and the feed may be varied from 5 to 14 cu. in. per minute as may be required. The miller is particularly adapted to such heavy work as paneling locomotive side-rods, which is perhaps as heavy work as such machines are called upon to do. The tool is powerful enough to remove 45 cu. in. of steel per minute when taking a "slabbing" cut.

With the alternating-current motor equipment shown in Fig. 2, the speed of the induction motor being fixed, it is necessary to provide a suitable run of gearing, which may be operated by a lever to obtain the required changes in speed. As before, the speed range is from 7 to 35 r.p.m. of the tool.

Westinghouse Exhibits at Grand Rapids.

One of the prominent exhibits at the annual meeting of the Michigan Electrical Association, held in Grand Rapids, Mich., Aug. 18 to 21, was that of the Nernst Lamp Company, of Pittsburg. The exhibit included a full line of the new Westinghouse-Nernst units, multiple and single-glower, for alternating and direct current. The many new features of these lamps, especially the screw burners and the wafer heaters, made the exhibit one of unusual interest to the lighting man present. The exhibit was beautifully illuminated by Westinghouse-Nernst 110-watt units. The company was represented at the convention by Mr. H. M. Browne, manager of the Detroit office, and Mr. J. O. Little, manager of the publicity department.

The Westinghouse Electric & Manufacturing Company was represented at the meeting by Mr. J. D. Noyes, local manager, and Mr. F. M. McAdams, Mr. L. Whiting and Mr. W. B. Wreaks, of the Detroit office, who presided at a tastefully arranged booth occupying the end of the main corridor next to the convention headquarters. The entertainment of the delegates included visits to the works of the Fox Typewriter Company, equipped with Westinghouse motor drive, and to the 110,000-volt transmission line of the Grand Rapids-Muskegon Power Company, which transmits power generated by Westinghouse apparatus at Croton Dams to Grand Rapids, where it is transformed down to 6600 volts by Westinghouse transformers.

Exhibits at Municipal Electricians' Convention.

One of the features of the annual convention of the Association of Municipal Electricians, held in Detroit last week, was an extensive exhibit by manufacturers of apparatus, appliances and material relating principally to fire-alarm and police signal installations.

Stanley & Patterson, New York City, showed a wireless battery outfit, wall brackets, weatherproof cell boxes, Hartford time switches and Faraday bells. It was represented by Mr. W. M. Petty.

The P. R. Manufacturing Company, Detroit, Mich., exhibited electric gongs and bells and vibrators. The exhibit was in charge of Mr. C. M. Proctor.

The Duplex Metals Company, New York City, exhibited Monnot copper-clad steel wire in sections and in various sizes, weatheproof wires, etc. It was represented by Mr. J. F. Kinder.

Frank B. Cook, Chicago, Ill., exhibited telephone protective apparatus and accessories and line supplies. Represented by Mr. Samuel C. Harvey.

Gould Storage Battery Company, New York City, exhibited cells suitable for fire alarm and police signal circuits.

The Gamewell Fire Alarm Telegraph Company, New York, showed a line of fire-alarm apparatus, and was represented by Mr. Frank F. Stover.

The Leeds & Northrop Company, Philadelphia, Pa., exhibited portable testing sets and cable-testing apparatus. Mr. Julius Bernstein was in charge.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

While business has remained extremely dull during the last week, especially in manufacturing and industrial lines, there has been some encouragement felt in commercial circles. Of course, the primary reason for this sentiment is the almost unprecedentedly large number of buyers who are in the market. The principal jobbing centers, especially New York City, are thronged with retail merchants who have come to replenish their depleted stocks. Hotels are crowded and wholesalers are rushed to the utmost limit showing goods. But as yet the actual buying is conservative. There is no reckless plunging, no chance-taking on long lines. Buyers are committing themselves very cautiously and are bargaining very closely. On the other hand, however, some orders are being placed and there is a marked gain in the distribution of fall and winter goods. A number of the jobbing markets report that, while the buying is small and frequent rather than individually heavy, the aggregate volume of business being transacted is larger than for a year past. The farming community, which is at last analysis the backbone of real prosperity, seems to be in excellent shape. The corn crop promises to be much larger than last year, and with one exception will probably be the largest ever grown. The other cereals, while not quite as satisfactory as at first hoped for, bid fair to be disposed of at higher average figures than ever before known, and so the return to the producer will be extremely gratifying. In the South the cotton crop is expected to break all records unless lack of rain in certain sections works a hardship. It is true that just at the present time the price of cotton to be delivered in the future is abnormally low—too low in fact for profitable production—but this is taken to be solely the result of a speculative campaign which cannot of course last, and it is improbable that very much actual cotton will pass from producer to consumer at these figures. Among the industries the most notable feature is the persistently growing increase in the inquiries for lumber, with prices showing a distinctly hardening tendency. One evidence of this improvement is the fact that the great mills on the Pacific Coast are preparing to resume operations on full time. In the iron and steel markets business continues to be light, the raw material being especially dull. There is little improvement in the manufacturing lines that is worthy of note, except that there has been a satisfactory increase in the inquiries for railway cars and track supplies. The leading item of the week was the placing of an order for 500, under steel frame, box cars, by a Southern road and the promise that the Harriman lines will soon be in the market with a large order for steel cars. Wire products are much more active, and the American Steel & Wire Company announces that it is running at 80 per cent capacity in order to fill present business. Business failures for the week ended Aug. 20, as reported by *Bradstreet's*, were 236, against 249 the week previous, 153 in like week of 1907, 155 in 1906, 176 in 1905 and 185 in 1904.

THE COPPER MARKET.

The copper market has been allowed to drift during the past week, and in consequence there has been little trading and no price changes. The manipulators, who have been apparently controlling the market as if it were their private property, have been content to rest inactive, and the speculators have seemingly tired of the game for the moment. Price fluctuations have been narrow, and while the tone has been undeniably weak there has been little pressure to sell, and nothing like demoralization. It has been evident at all times that the market is in leash, and has been apparent that any return of speculative activity would result in advanced prices. The only change in the statistical position of copper has been the increase in exports during the week. Exports for the month up to Aug. 24 have been about 20,000 tons, and there is every indication that during the remaining days there will be sufficient shipments to carry the total beyond the June record, and possibly to the neighborhood of 30,000 tons. Imports have in the meantime continued to be unusually heavy, domestic production has continued on the liberal scale that has been adopted for the summer, and there has been only a slight increase in the domestic consumption. The apparent supply for the month from all sources will be fully 100,000,000 lb., which, even with the high export figures, indicates an increase in domestic stocks of at least 20,000,000 lb. Market expressions as a rule are bullish, in spite of the adverse statistical position. Mr. Horace J. Stevens, of Houghton, Mich., for instance, expects to see American consumers buying copper at 16 cents during the fall. He says that the Europeans have been the purchasers at 13 cents, and that it will take a sharp advance in prices to stir up the Americans. One story that caused some interest during the week was that the European speculators who have been upon the bull side of the market since it was around 12½ cents have borrowed $50,000,000 to finance their operations, and that with the money market in its present condition they are assured of all the resources they need to carry through their programme. Whether this report is true or not, there certainly has never been any indication of the slightest financial annoyance among the European buyers. The total exports from New York for August, up to Aug. 24, were 19,986 tons, of which 3840 were shipped on the date named. Prices quoted on the Metal Exchange Aug. 24 were:

Lake	13½ @ 13⅝
Electrolytic	13⅜ @ 13½
Castings	13⅛ @ 13¼

The London market was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	60 0 0	60 0 0
Standard copper, futures	60 15 0	60 15 0
Market	Quiet.	Quiet.
Sales of spot		200 tons
Sales of futures		400 tons

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅜	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£56 5 0
London, futures	64 10 0	56 17 6
London, best selected	67 10 0	60 0 0

WESTINGHOUSE MOTORS FOR MEXICO.—The Virginia & Mexico Mining & Smelter Corporation, of Hostotipaquillo, Jalisco, has in transit from the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., whose agents for Mexico are Messrs. G. & O. Braniff & Co., a number of electric motors to be used in connection with its new mill. There will be some 15 motors, totaling over 300 hp, the majority of which will be used for belt drive. There is to be a 30-stamp mill, with each 15 stamps driven by a separate 30-hp motor. A 20-hp motor will drive 10 Wilfley concentrating tables. One 30-hp motor will be used to drive three crushers, a second to operate an air-compressor, mechanical agitator and vacuum pump, and a third to drive three solution pumps and three Frenier pumps. A 10-hp motor will operate a Robins belt-conveyor for handling the sands, etc. Mr. Jesse Scobey is manager of the property.

NEW EQUIPMENT FOR THE ALBANY & HUDSON RAILROAD COMPANY.—Plans are being prepared for doubling the output of the Stuyvesant Falls station of the Albany & Hudson Railroad Company of Hudson, N. Y. A 2000-hp steam turbine unit and a 500-kw motor-generator set will be installed in the fall or early spring. For some time the company has had under contemplation the erection of a dam on Tasawassa Lake, but this development has been abandoned. The new installation will give the company a steam reserve of 4700 hp to supplement its water power output.

NEW POWER PLANT FOR BATH, N. Y.—The Citizens' Electric Service Company, of Bath, N. Y., has obtained a franchise for erecting and operating an electric light plant in the city of Bath. The equipment to be installed will consist of three 100-kw alternators, direct-connected to gas engines fed with producer gas. The Tower Engineering Company, of Buffalo, N. Y., of which E. J. G. Tower, of the King Iron Works, is general manager, will install the equipment. A new type of gas engine will be employed.

STANDARD GAUGE MANUFACTURING COMPANY.—The Schaeffer & Budenberg Company has sold its plant at Foxboro, Mass., to the Industrial Instrument Company, which was lately organized, with Bennett B. Bristol, formerly of the Bristol Company, Waterbury, manufacturer of recording instruments, as its head. The Standard Gauge Manufacturing Company will operate the plant for the manufacture of guages, recording instruments, etc., and the property will be deeded to that company by the Industrial Instrument Company, as the same interests control both concerns. Watson E. Goodyear, Naugatuck, Conn., will be president of the Standard Gauge Manufacturing Company; Bennett B. Bristol, treasurer, and Arthur E. Mundy, Syracuse, N. Y., secretary. The plant is modern and well equipped, with two main buildings of brick, 60 x 210 ft. each, and a foundry 60 x 150 ft., which was added a few years ago at a cost of $20,000. No extensive orders for equipment will be placed at once, but different machine tools will be ordered as required.

GENERAL ELECTRIC WILLING TO WAIT.—There will be no further attempt made at the present time by the General Electric Company to develop its large property holdings near Erie, Pa. The company is willing to wait until business conditions have improved. The property has cost the company about $232,000 and comprises a tract of 700 acres. It is planned that ultimately a very large plant will be located there which, it is believed, on account of its geographical situation, will result in several economies. The plant will be near the source of fuel supplies, and the element of distance in relation to the shipments of iron products, will also be considerably shortened. Accordingly there will be a considerable saving in freight costs. It is believed, also, that no little saving in labor costs will be possible.

EXTENSION OF HOUGHTON COUNTY TRACTION.—The Houghton County Traction Company, of Houghton, Mich., has contracted with the Stone & Webster Engineering Corporation for the extension of its lines from Wolverine, Mich., to Mohawk, Mich. The contract includes the construction of the track, bridges, overhead work, a car barn, a small substation and the purchase of some new cars. The work as planned will cost about $125,000.

HAUSER LAKE COFFER DAM.—The Stone & Webster Engineering Corporation has purchased from the Grays Harbor Commercial Company about 2,000,000 ft. of timber for building the coffer dam in the construction of the new 20,000-hp Hauser Lake Dam, which they are erecting for the United Missouri River Power Company on the Missouri River near Helena.

ELECTRIC SCARF PINS are, by a recent decision of the General Board of Appraisers of the U. S. Customs Service, subject to a duty of 60 per cent as articles of jewelry instead of 45 per cent as manufactures of metal.

Financial Intelligence.

THE WEEK IN WALL STREET.

The professional character of the Wall Street stock market was made plainly apparent during the past week. It has been well known, of course, during the upward movement that has marked the course of the market for three months past that public participation was limited. There has been some buying for investment, in fact, there has been considerable taking of small lots, but outsiders have done little speculative trading. Professionals have pushed prices up and when they were elevated professionals have been so eager for profits that their selling has caused reactions. During the greater part of last week—the week ended Aug. 24—that element in the stock market who had gone on the short side when prices were at the top, worked diligently for a further reaction without any very conspicuous success. There were some breaks and sometimes selling was active, but there always seemed to be enough support accorded from the long side to check the downward movements before they had been carried very far, and in most cases the rallies were as sharp as the declines. As far as the news of the week went, there was very little for the bears to work upon. Conditions were favorable for a strong market, or at least were as favorable as they have been since the crop situation has been practically settled. Good reports from the growing sections, extremely cheap money and mildly encouraging news from industrial and commercial centers all tended to discourage any downward movement. One significant feature of the news was the demonstration of the fact that the railroads have finally worked out their own salvation by the inauguration of the most rigid economies. While the reports continue to show very large losses in gross earnings, the policies of retrenchment have in most instances brought the reductions in net to a minimum. The Baltimore & Ohio, for instance, for the month of July reported a loss in gross earnings of $1,529,798, but the loss in net was only $280,532 which is only one-fifth of the loss in net for the month of May. The Harriman lines—Southern Pacific and Union Pacific—did even better. For the month of June each road returned a heavy loss in gross earnings, yet each showed some increase in net. The market of Saturday, Aug. 22, was in many respects one of the most remarkable in the history of the Street. More than a million shares were traded in during the short two-hour session and prices jumped back and forth in the most erratic manner. After furious trading in a dozen market leaders the net changes of the day were mostly fractional advances. One house alone handled 730,000 shares. But the professionals carried the game too far. Charges of matched sales, and washed sales are made with so much evidence that they are true that the conservative brokers of the Street are disgusted and the Stock Exchange officials have begun a rigid investigation which may result in drastic discipline for the thimble-riggers. Those who have the interest of Wall Street at heart are sorely vexed at a course of flagrant manipulation that will check any move toward a return of public confidence and is sure to encourage adverse legislation at Albany. The result of such antics was shown in the market of Monday, Aug. 24, when less than 400,000 shares were sold. On Aug. 25, before the closure of the Exchange, the failure of A. O. Brown & Company, the plunging firm above referred to, was announced. Although the failure may run into the millions, the market was not disturbed. Money on this date was even cheaper than the usual rate during the summer. Call loans ranged from ¾ to 1 per cent, and 90-day paper was in light demand at 2½ to 2¾ per cent. The quotations in the table are those of the close Aug. 24.

NEW YORK.

	Aug. 17.	Aug. 24.	Shares Sold.		Aug. 17.	Aug. 24.	Shares Sold.
All.-Ch.	11⅝	11⅝	2,900	Int. Met., pfd..	33½	32	13,450
All.-Ch., pfd...	35¼	34½	5,220	Mackay Cos....	68	68*	100
Amal. Cop.....	77¼	76¾	240,345	Mackay Cos., pfd.	68⅜	68	20
Am. D. T.....	39*	39*	——	Manhattan Elev.	138*	135	——
Am. Loc.....	56	55⅛	13,327	Met. St. Ry....	38*	34½*	——
Am. Loc., pfd..	107*	105	200	N. Y. & N. J. Tel.	110⅛	110¼*	100
Am. Tel & Cbl.	64½*	64½*	——	Steel, com.....	45⅜	45	481,760
Am. T. & T....	123½	124½	8,000	Steel, pfd.....	108⅞	108⅛	14,900
B. R. T.....	53	51½	33,885	W. U. T.....	56½*	55	800
Gen. Elec.....	142	143	1,554	West'h, com...	68½	70¾	10,300
Int. Met., com.	11⅞	11¼	6,835	West'h, pfd....	92*	92*	——

PHILADELPHIA.

	Aug. 17.	Aug. 24.	Shares Sold.		Aug. 17.	Aug. 24.	Shares Sold.
Am. Rys.....	46	45⅞	——	Phila. Elec.....	9⅞	9⅝	——
Elec. Co. of A..	10	10⅛*	——	Phila. R. T.....	13½	13¾	——
Elec. Stor. B'ty.	38	38½	——	Phila. Traction..	89	88*	——
E. S. B'ty, pfd..	49*	49*	——				

CHICAGO.

	Aug. 17.	Aug. 24.	Shares Sold.		Aug. 17.	Aug. 24.	Shares Sold.
Chi. City Ry...	176½*	176½*	——	Met. El., com...	15	13½	——
Com. Edison....	104¾	107	——	Met. El., pfd...	45	45*	——
Chi. Subway....	21½	21½*	——	Nat'nal Carbon.	72½	72½	——
Chi. Tel. Co....	145⅛	145¾	——	Nat. Carb., pfd.	108½	108½*	——

BOSTON.

	Aug. 17.	Aug. 24.	Shares Sold.		Aug. 17.	Aug. 24.	Shares Sold.
Am. Tel. & Tel..	123½	124¾	——	Mass. E. R., pfd.	49*	48	——
Comb'ind Tel...	115½	115½*	——	Mex. Tel., pfd..	6*	6*	——
Gen. Elec.....	143	143⅛	——	N. E. Tel'p.....	113	114½	——
Edison El. Ill..	—	214½*	——	W. Tel. & Tel..	6*	6½	——
Mass. Elec. Ry..	10½	9½	——	W. T. & T., pfd.	72	70	——

*Last price quoted.
Shares sold are for week Aug. 17 to Aug. 22.

REFINANCING NEW YORK CENTRAL TRACTIONS.

In order to comply with the New York State law which prohibits any corporation not a railroad or street railroad from holding more than 10 per cent of the stock of any railroad or street railroad, the Public Service Commission of the second district of New York has approved the New York Central's plans for refinancing its traction holdings. These properties have been held by the Mohawk Valley Company, a holding organization. The main feature of the plan is the elimination of the Mohawk Valley Company and the transfer of the traction securities directly to New York Central ownership. Concerning this course the commission remarks: "Authorizing a steam railroad to acquire the ownership of a city electric street railroad as an original proposition would, to put it mildly, not be looked upon with favor by this commission, but in this case

the existing situation seems to justify another point of view." The companies in which the Mohawk Valley Company is interested and the extent of its holdings therein are as follows:

Company.	Outstanding.	Holdings.	%.
Utica & Mohawk Valley	$7,500,000	$7,500,000	100
Oneida Railway Co	1,923,000	1,922,700	99.98
Syracuse Rapid Transit Ry. Co	3,918,071	2,317,500	59.14
Rochester & Eastern Rapid Ry. Co.	1,500,000	1,500,000	100
Schenectady Railway Co	4,100,000	2,050,000	50
Rochester Electric Railway Co	200,000	173,900	86.95
Rochester & Suburban Ry. Co	420,000	400,800	95.42
Rochester & Sodus Bay Ry. Co	1,850,000	1,100,000	59.45
Ontario Light & Traction Co	100,000	100,000	100
Rochester Railway Company	6,000,000	900	.03
Rochester Ry. & Light Co	9,498,860	7,638,900	80.41
Canandaigua Ry. & Can. Gas Lt. Co.	50,000	20,550	41
Eastern Monroe E. L. & G. Co	250,000	250,000	100

The first step in the plan is for the Mohawk Valley Company to reduce its capital stock by distributing $17,065,800, par value, traction stocks pro rata among its stockholders. The New York Central as holder of $12,000,000 Mohawk Valley stock would receive as its share $10,230,480 in the stocks of various companies. Next, the New York Central is to purchase 29,987 shares of the Rochester Railway Company, which is now owned by the Rochester Railway & Light Company, a lighting corporation, which is in turn largely owned by the Mohawk Valley Company. For this it is proposed to pay $4,500,000, or substantially $150 per share. It is provided that the purchase price shall not be paid until the stock is free from the lien of the mortgage for a similar amount now held by the New York Central Company, but that such purchase price shall be placed in escrow ready to be delivered whenever the proper arrangements can be made freeing the stock from its present lien. The New York Central is next authorized to purchase 82,741 1-5 shares of stock of the Rochester & Eastern Rapid Railway Company, the capitalization of which is to be increased to $15,000,000, in order that it may become the owner of the entire stock of the Oneida Railway Company and the Utica & Mohawk Valley Railroad Company, the three corporations being merged into a consolidated company. The consolidated company is also to acquire the stocks of various other companies held by the Mohawk Valley Company. By this process of elimination the total number of companies is reduced to three, namely, the Schenectady Railway Company, Syracuse Rapid Transit Company and the new consolidated company. The net result of the changes will be that the New York Central instead of owning stock in the Mohawk Valley Company will own the controlling interest in the three companies above named. The commission explains its action by saying: "It is clearly understood that these applications are granted upon the express understanding that it is contemplated by the applicants to consolidate and merge the companies and to place a general refunding mortgage upon the property of the consolidated company, and that these applications are granted for the express purpose of bringing about the final results as indicated."

DIVIDENDS.

Terre Haute (Ind.) Traction & Light Company, preferred, semi-annual 3 per cent, payable Sept. 1.

American Railways Company, Philadelphia, quarterly, 1½ per cent, payable Sept. 15.

Federal Mining & Smelting Company, preferred, quarterly, 1¾ per cent, payable Sept. 15.

National Lead Company, common, quarterly, 1¼ per cent, payable Oct. 1.

Twin City Rapid Transit Company, preferred, quarterly, 1¾ per cent, payable Oct. 1.

TO ASK MORE TIME FOR WESTINGHOUSE COMPANY.—Mr. James W. Marsh, chairman of the Merchandise Creditors' Committee of the Westinghouse Electric & Manufacturing Company, is quoted as saying that it is likely the various committees will ask the Readjustment Committee for a further extension of time in which to work out the reorganization of the company now under way, when the present time limit is reached on Sept. 1. Mr. Marsh reports that about 95 per cent of the Merchandise Creditors have agreed to take new assenting stock for their claims, that about 75 per cent of the stockholders have subscribed for new stock and about 60 per cent of the bank creditors. Since the last extension was granted on June 22 but few new subscriptions from stockholders or from merchandise creditors have been secured. Some success has been met among the bank creditors, but not nearly enough to clear up the portion allotted to these creditors. This is explained by the various committees working for the reorganization by the fact that so many stockholders and bankers are away from their homes on vacations. It is said that this has been found to be especially hampering in the case of banks where so many directors were absent that no meeting could be held for the purpose of voting assent. As a matter of fact, little progress has been made since June and there are still several millions to be assured before the plan can be definitely declared to be a success. Mr. Marsh, however, expresses full confidence in the ultimate consummation of the plan.

INCREASED EXPENSES CUT NET EARNINGS.—The report of the Philadelphia Rapid Transit Company shows to a marked degree the manner in which the expense account of tractions has outrun the gross earning capacity. For the year 1907 the gross earnings of the company were $18,095,503, an increase of $612,359, but the operating expenses were $10,046,487, an increase of $892,884, resulting, of course, in a decrease in net earnings. Damage suits have been one of the heavy items of expense, but the most remarkable increase has been in the wage account. In 1907 the payroll was $938,000 greater than in 1906, an increase greater than the increase of $612,000 in gross earnings for that 12 months. In the two years 1905-07, the payroll increased $1,657,000 and the gross earnings of the company increased $1,907,000. Wages in 1907 amounted to 43.2 per cent of gross earnings as against 30.1 per cent in 1900 and 36.1 per cent in 1897. Employees have so far participated in the growth of business that the payroll now bears a much larger proportion to it than ever before in the history of the company.

TO VOTE ON BOND ISSUE.—Messrs. Harry C. Bronner, George C. Smith and James N. Wallace, voting trustees for the Northern Colorado Power Company, of Bertboud, Col., have sent out notices that a meeting of the holders of voting trust certificates for preferred and common stock will be held Sept. 5, to vote on the authorization of a $6,000,000 issue of 5 per cent bonds to be secured by a mortgage on the property and franchises of the company.

PURCHASE FAIRMONT & CLARKSBURG TRACTION BONDS.—A syndicate headed by Chandler Bros. & Company and the Fidelity Trust Company of Baltimore has taken over the unsold portion, amounting to something over $400,000, of the $2,500,000 first mortgage bond issue of the Fairmount & Clarksburg (W. Va.) Traction Company. The bonds will be offered at 93 and interest, to pay about 5½ per cent.

MACKAY COMPANIES DEVELOPING.—The Mackay Companies report increasing business and a generally very satisfactory condition. The company is installing a call box system throughout the West Indies in competition with the Western Union and its service is being extended in many portions of Europe. All of these improvements are being financed from the current funds of the company without new capital issues.

PHILADELPHIA COMPANY'S NOTES OFFERED.—Charles D. Barney & Company, of New York, who with the Union Trust Company, of Pittsburg, recently purchased $2,600,000 of the new 6 per cent collateral trust notes of the Philadelphia Company, are offering the unsold balance to the public at about 98. Over two-thirds of the issue, of which $3,500,000 was originally authorized, has been already taken.

WESTCHESTER RAILROAD COMPANY'S DEFICIT.—Mr. J. Addison Young, receiver for the Westchester Electric Railroad Company, has reported to the Public Service Commission of the First District of New York that the deficit in the operation of the property during the quarter ending June 30, 1908, was $16,037. The gross earnings were $97,747, the operating expenses $104,102, and the fixed charges $9,819.

TO MERGE MEXICAN COMPANIES.—Officials of the Mexican Light & Power Company, of Mexico City, and of the Mexican Tramways Company are in Montreal, Can., where the concerns are principally owned, negotiating a deal that will either result in the merging of the two concerns or in the leasing of the Tramways company to the larger corporation.

Reports of Earnings of Electrical Companies.

	Gross Earnings.	Operating Expenses.	Net Earnings.	Charges.	Surplus.
El Paso (Tex.) Electric Company:					
June, 1908	$41,995	$30,397	$11,598	$7,415	$4,184
June, 1907	41,030	29,268	11,762	5,548	5,815
Galveston-Houston Electric Company:					
June, 1908	$92,442	$53,235	$39,207	$18,400	$20,807
June, 1907	95,597	55,366	40,231	15,886	24,345
Jacksonville (Fla.) Electric Company:					
June, 1908	$35,882	$23,876	$12,005	$8,259	$3,710
June, 1907	34,162	18,855	15,307	6,094	9,213
Pensocola (Fla.) Electric Company:					
June, 1908	$19,020	$14,020	$5,000	$4,315	$685
June, 1907	19,850	11,468	8,382	3,768	4,615
Brockton & Plymouth (Mass.) Street Railway Company:					
June, 1908	$12,152	$8,915	$3,238	$2,264	$973
June, 1907	12,360	8,017	4,343	2,239	2,104
Savannah (Ga.) Electric Company:					
June, 1908	$50,006	$30,498	$19,508	$15,656	$3,852
June, 1907	51,836	31,399	20,437	13,948	6,489
Seattle (Wash.) Electric Company:					
June, 1908	$358,207	$202,875	$155,332	$86,351	$68,981
June, 1907	$339,510	$202,511	$137,000	$70,214	$66,785
Puget Sound Electric Railway Company, Tacoma Wash.:					
June, 1908	$141,645	$87,141	$54,505	$38,526	$15,978
June, 1907	147,200	83,232	63,968	33,818	30,150
Northern Texas Electric Company, Fort Worth, Tex.:					
June, 1908	$90,550	$66,051	$24,499	$19,191	$5,308
June, 1907	92,588	51,183	41,405	13,124	28,281
Houghton (Mich.) County Street Railway Company:					
June, 1908	$23,343	$12,781	$10,561	$4,624	$5,938
June, 1907	22,438	11,313	11,125	4,695	6,430
Dallas (Tex.) Electric Corporation:					
June, 1908	$88,501	$71,654	$16,846	$26,098	$9,251
June, 1907	91,926	61,383	30,543	22,862	7,681
Whatcomb (Wash.) County Railway & Light Company:					
June, 1908	$26,129	$16,861	$9,267	$7,980	$1,297
June, 1907	27,362	15,941	11,421	7,490	3,932
Edison Electric Illuminating Company, Brockton, Mass.:					
June, 1908	$14,833	$8,145	$6,688	$2,390	$4,297
June, 1907	14,172	8,240	5,931	1,866	4,065
Cape Breton (C. B.) Electric Company:					
June, 1908	$19,959	$11,564	$8,394	$4,046	$4,348
June, 1907	20,685	12,217	8,468	3,932	4,536
Electric Light & Power Company of Abington and Rockland Mass.:					
June, 1908	$4,315	$2,525	$1,789	$354	$1,435
June, 1907	4,014	2,641	1,373	385	987
Minneapolis General Electric Company:					
June, 1908	$70,766	$31,837	$38,928	$31,507	$7,420
June, 1907	68,572	29,033	39,538	25,614	13,924
Lowell (Mass.) Electric Light Corporation:					
June, 1908	$25,494	$16,125	$9,369	$4,006	$5,362
June, 1907	23,401	13,827	9,574	3,082	6,492
Houghton (Mich.) County Electric Light Company:					
June, 1908	$15,994	$9,457	$6,537	$3,237	$2,965
June, 1907	15,570	9,613	5,957	2,738	3,219
Aurora, Elgin & Chicago Railroad Company:					
July, 1908	$148,748	$72,208	$76,540	$27,778	$48,762
July, 1907	152,252	74,908	77,344	27,508	49,836
American Telephone & Telegraph Company:					
July, 1908	$3,817,901	$173,991	$3,643,910	$614,494	$3,029,416
July, 1907	3,529,193	191,235	3,337,958	587,146	2,750,812
United Railways Company, St. Louis:					
July, 1908	$898,210	$578,528	$319,682	$232,682	$86,830
July, 1907	941,878	573,936	367,942	232,510	135,432
Cuyahoga Telephone Company, Cleveland:					
Year 1907	$781,586	$346,913	$434,673	$207,458	$227,215
Year 1906	716,157	339,038	377,119	204,878	173,241
United States Telephone Company, Cleveland:					
Year 1907	$435,013	$184,135	$250,878	$116,877	$168,966
Year 1908	402,052	159,414	242,638	121,342	139,398
Montreal Street Railway Company:					
July, 1908	$326,524	$162,413	$164,111	$65,012	$99,098
July, 1907	339,756	175,946	163,810	67,733	96,077
Peekskill (N. Y.) Lighting & Railroad Company:					
April 1 to June 30, 1908	$16,564	$9,671	$6,893	$9,485	$9,641
April 1 to June 30, 1907	17,139	9,561	7,561	8,641	10,060

GENERAL NEWS

Construction News.

SEWARD, ALASKA.—The Seward Light & Power Company contemplates installing a larger water wheel and making extensions to its pipe line. S. M. Graff is general manager.

EUREKA, CAL.—Plans are being considered to make improvements and extensions to the street railway system of the Humboldt Transit Company. George Hazleton, of San Francisco, Cal., is president of the company.

FRESNO, CAL.—Geo. L. Hoxie, city engineer, writes that the question of lighting the business section of the city with electroliers, to replace present arc lights, in under consideration; probable cost $29,000.

LOS ANGELES, CAL.—A. B. Salisbury, representing a syndicate of local and eastern men, has purchased the Lookout Mountain Park, of F. B. Yoakum, and is formulating plans for a pleasure resort. The cost of the railway is estimated at $100,000.

LOS ANGELES, CAL.—Amended articles of incorporation have been filed for the United States Long Distance Telephone & Telegraph Company. The company is capitalized at $3,000,000, and expects to operate 700 miles of telephone lines extending from Tia Juana, Mex., to Bakersfield, Cal., and from Los Angeles to Redlands and San Bernardino. The directors are C. A. Gates, A. F. Morlan, L. J. Maguire, J. B. Samuel and W. B. Brown, all of Los Angeles.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company has put its new generating plant on Deer Creek, near Nevada City, in operation. The plant has an output of 8000 hp.

SAN FRANCISCO, CAL.—Repairs are being made and additional machinery is being installed in the North Beach power house of the United Railroads of San Francisco, which was badly damaged at the time of the earthquake. The equipment includes a 5000-kw. Curtis turbo-generator set, with all auxiliaries, boilers, condensers, pumps, etc.

SAN FRANCISCO, CAL.—Extensive improvements to provide for an increased lighting service are being made by the Oakland Gas Light & Heat Company. An addition costing $35,000 will be erected and in it will be installed a 9000-kw steam turbine generating unit. Work on the plant will begin at once.

SAN JOSE, CAL.—The Southern Pacific Railroad Company has purchased the Santa Clara Interurban Railway, including private rights of way between Santa Clara and San Mateo, power houses and franchises in Palo Alto and some rolling stock. It is said that work will commence on the new electric railway in the near future, which will extend from Santa Clara to Palo, and thence to San Francisco. L. E. Hanchett, of San José, is president of the Santa Clara Interurban Railway Company.

BOULDER, COL.—The Colorado Eastern Power Company contemplates the construction of a reservoir four miles northeast of the city, which will be the third built by the company, and will be known as the Twin Lake Reservoir. The cost of the work is estimated at $200,000. J. W. E. Taylor is superintendent.

BOULDER, COL.—The Ordell Ditch & Power Company, which is a subsidiary of the Colorado Eastern Power Company, has filed plans with the county clerk for its proposed hydraulic development at Boulder Creek. The plant will be located in the western part of the city, and will secure its water power from the Colorado Eastern Power Company. The company proposes to construct a pipe line, beginning about three miles up Boulder Canyon, where water will be taken from the river into a pipe, five ft. in diameter, which will give the company a fall of 460 ft. to the power house, which will be built near Boulder Creek. The plant will have an output of about 6000 hp. and will cost about $250,000.

DENVER, COL.—A special meeting of the stockholders of the Northern Colorado Power Company will be held in Denver Sept. 5 to vote on the proposition to authorize a mortgage to secure an issue of $6,000,000 in bonds.

DENVER, COL.—At a meeting of the stockholders of the Southern Colorado Power Company held in the Mercantile Building on August 15 a bond issue of $1,500,000 was authorized for the purpose of enlarging the power plants, railway lines and light systems owned by the company in the southern part of the state. It is said that practically all the mines of the Coloralo Fuel & Iron Company is that section of the state will be operated by electricity as soon as plans can be consummated. J. J. Henry, president; L. C. Duncan, secretary.

FLORENCE, COL.—The Eastern Colorado Electric Power Company, which is now constructing a generating plant near Glenwood Springs, has filed an application for permission to use the undeveloped water of Grape Creek. The company proposes to furnish electrical power to operate several mills and smelters in this county.

WASHINGTON, D. C.—Bids will be received until Sept. 1 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the navy yards and naval stations named the following supplies: New Orleans, La. Schedule 195—semi-enclosed motor; electromagnetic separator, etc. Mare Island, Cal. Schedule 212—20,000 ft. aerial wire; six primary condensers; 96 Locke insulators; porcelain insulators, etc. Application for proposals should designate the schedule desired by number. E. B. Rogers is paymaster-general.

ST. AUGUSTINE, FLA.—Arrangements are being made by the St. Johns Light & Power Company to extend the electric railway service over the river to New Augustine in the near future. T. R. Osmond is manager.

ATLANTA, GA.—Bids will be received at the Department of Justice, office of the superintendent of prisons and prisoners, until Sept. 9, for furnishing and delivering at the United States Penitentiary, Atlanta, Ga., one 25-hp. electric motor and material, in accordance with specifications, copies of which, together with further information, may be obtained upon application at the above office. R. V. Ladow is superintendent of prisoners and prisons.

TYBEE, GA.—The Town Council is considering the question of installing a municipal electric light plant, and will soon take steps to secure estimates of the cost of the same. Robert P. Lovell is mayor.

BOISE, IDAHO.—Frank H. Buhl, of Sharon, Pa., and Kuhn Brothers, of Pittsburg, Pa., are interested in an irrigation project in Idaho. The Buhl interests will take up the irrigation project and the Kuhn Brothers the right of way and exclusive control of the water power and electric railways for the tract. The cost of the work is estimated at $20,000,000.

MINIDOKA, IDAHO.—Contracts have been awarded by the Secretary of the Interior at Washington, D. C., for the electrical apparatus for use in connection with the power plant in connection with the Minidoka irrigation project, Idaho, as follows: To the General Electric Company, of Schenectady, N. Y., approximately $7,660; S. Morgan Smith Company, of York, Pa., about $11,500; Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., about $115,000, and Allis-Chalmers Company, of Milwaukee, Wis., two contracts amounting to about $101,517 and $39,710, respectively.

MONTPELIER, IDAHO.—The Montpelier Electric Light Company and the Bear Lake Valley Railway & Electric Company have been consolidated under the name of the Bear Lake Power Company, Ltd., which has been incorporated to take over the old companies, new stock being issued on an equitable basis for old. The officers of the new company are: L. I. Evans, president; Alfred Budge, vice-president; James Redman, treasurer, and J. A. Tupper, general manager. A number of important improvements will be made in the service and equipment of both plants.

CANTON, ILL.—The Lewiston Home Telephone Company has applied for permission to erect a telephone system in Canton.

ELWOOD, IND.—By decree of court the Citizens' Heat & Light Company of this city will be sold to the highest bidder September 18 in order to pay debts and interest. The Citizens' Heat & Light Company owns the electric light plant and also all the gas plant of Elwood, which were pooled when the heat and light company was organized. The sale of the plant will be followed by the organization of another company with more local capital.

FORT WAYNE, IND.—The municipal electric light plant will soon be placed in operation, and will furnish electricity for about 425 magnetite street arc lamps.

LOGANSPORT, IND.—Plans and specifications for a new municipal electric light plant have been submitted to the Board of Public Works by Prof. J. Walter Esterline, of Purdue University. The plans provide for the installation of a 500-kw 60-cycle turbo generator and also a 150-kw generator, which will be belted to a Buckeye engine. The city arc lights are to be changed and a new and large smoke stack is to be erected. More water power is to be used than heretofore and, according to plans, there will be an annual saving of $9,000 in coal and $960 in arc light bills, besides an increase in power from 600 to 700 kilowatts. The City Council has appropriated $38,000, the estimated cost of the plant, and Prof. Esterline has been engaged to supervise the purchase and installation of the new equipment.

PORTLAND, IND.—The city is contemplating installing a new steam power plant in connection with the municipal electric light plant, power for which is now rented. J. B. Milligan is superintendent.

IOWA CITY, IA.—Frank Benjamin, of Galesburg, Ill., is reported interested in a project to install an electric light plant.

MASON CITY, IA.—It is reported that Ira Knapp, of Mason City, will erect four miles of transmission lines to supply electrical power to the Mason City Vulcan Iron Works.

SLOAN, IA.—F. W. Schreiber, of Sloan, is interested in a project to establish an electric light plant in this town in the near future. It is proposed to organize a stock company and install a plant with sufficient output to supply 2000 lamps.

ALMA, KAN.—The Alma Light & Ice Company contemplates installing a 10-ton ice plant in its plant this winter.

WICHITA, KAN.—Arangements are being made to extend the independent trunk telephone lines from Wichita to Abilene, Kan., to connect the Oklahoma service with the up-state systems, and later a telephone line will be erected to Omaha. It is also proposed to double the service between Abilene and Kansas City.

HAZARD, KY.—The Perry County Telephone Company is making arrangements to erect a telephone line from Hazard to Jackson, a distance of about 40 miles. D. Y. Combs is manager.

LOUISVILLE, KY.—The so-called Fetter electric lighting franchise, giving the privilege to sell electricity in a restricted portion of the business section of the city, was sold at public auction Aug. 17 to Hardy Burton, for $45,515.

SOMERSET, KY.—It is reported that Chicago. Ill., and Louisville, Ky., capitalists are contemplating the purchase of the franchise and property of the Somerset Water, Light & Traction Company, and will make improvement to the system.

ANDOVER, MAINE.—The Citizens of Andover and Perth, Maine, are considering the question of forming a stock company for the purpose of procuring electricity from the hydro-electric plant of the Maine & New Brunswick Electrical Power Company's plant at Aroostook Falls to be distributed in the two villages for lamps and motors. A. R. Gould, of Presque Isle, Maine, is general manager of the electric company.

HAGERSTOWN, MD.—The American Union Telephone Company contemplates making extensive improvements and extensions to its system, which will involve an expenditure of about $90,000.

ADAMS, MASS.—The contract for the installation of an electric light plant at the town farm was awarded to J. L. Barber, of North Adams, for $1,160. The plant will be operated by water power, but the equipment includes an auxiliary gas engine.

AMHERST, MASS.—George B. Burnett & Son have installed a turbo-generator set in their shop, to furnish electricity for lamps and motors.

ANDOVER, MASS.—The Lawrence Gas Company contemplates installing a new street electric lighting system in Andover. The question of establishing an all-night service instead of until midnight, as at present, is under consideration.

AYER, MASS.—Owing to the failure of the Selectmen and the Ayer Electric Company to come to an agreement in regard to the lighting contract the electric light company has discontinued the service and the streets of the town are in darkness.

BERLIN, MASS.—At a special town meeting held recently the citizens voted to enter into a contract with the Marlboro Electric Light Company to light the streets of the town and the city hall for a term of five years. Under the terms of the contract the company agrees to furnish 32 incandescent lamps of 40 cp. at the rate of $17 per lamp per year.

CHESTER, MASS.—The Board of Gas and Electric Light Commissioners has rendered a decision in the case of the petition of the Selectmen of Chester, asking for a reduction in the price of electricity for lamps charged by the Chester Electric Light Company, of which E. LeRoy Gardner is proprietor; also for a change in the method of fixing the price for lighting. The Commission voted to dismiss the petition of the Selectmen and advised the Selectmen and the company to get together in regard to the service, which is of great benefit to the town and no great profit to the company.

LEE, MASS.—The Lee Electric Light Company has completed its transmission to Lenoxdale, and is now furnishing electricity for lighting the town.

LOWELL, MASS.—A new 1500-kw. turbo-generator set has been installed in the power plant of the Tremont & Suffolk Mills. The company proposes to operates its plant entirely by electric power.

MANCHESTER, MASS.—A new turbo-generator set has been installed in the new mill of the Cheney Brothers, and will generate electricity to operate the new ribbon mill.

PITTSFIELD, MASS.—The Berkshire Street Railway Company is planning to construct a private telephone system from Bennington, Vt., to Great Barrington, Mass.

SPRINGFIELD, MASS.—The power plant of the United Electric Company has been completed and is now in operation. The cost of the plant is estimated at about $300,000. Only one 3000-hp steam turbine has been installed, but arrangements have been made to place four turbines with a total output of 12,000. The turbine is of the Parsons type manufactured by the Westinghouse Electric & Manufacturing Company.

DETROIT, MICH.—The Public Lighting Commission has entered into a contract with the Westinghouse Electric & Manufacturing Company for the purchase of a turbo-generator set, similar to the one now in use at the municipal electric light plant, to cost $53,000. The commission is considering the question of installing flaming arc lamps on Woodward Avenue from the river to Grand Circus Park.

MACATAWA, MICH.—The Macatawa Resort Company contemplates doubling the output of its electric light plant next year. S. A. Miller is manager.

SHEPHERD, MICH.—The citizens are reported to have voted to issue $20,000 bonds for water works and an electric light plant.

SPARTA, MICH.—E. G. Anderson, Village Clerk, writes that it is not proposed to construct municipal electric light plant, as previously reported.

WYANDOTTE, MICH.—Henry A. Everett has applied to the City Council for a franchise to construct an electric railway on the streets of the city.

COLD SPRING, MINN.—The Farmers' Milling Company contemplates installing an electric light plant.

DULUTH, MINN.—Plans are being made to improve the long-distance telephone service between Duluth and Superior, Wis., which will include the laying of heavy cables between the two cities.

MINNEAPOLIS, MINN.—The City Council on Aug. 17 voted to postpone action on the electric franchise ordinance until after the fall election.

MOTLEY, MINN.—Motley Telephone Company has been granted a franchise to operate a telephone system in Motley.

PIPESTONE, MINN.—The North Star Telephone Company has completed the erection of a telephone line between Pipestone and Altoona, and is considering other extensions to its system.

REDWOOD FALLS, MINN.—R. F. Wherland, manager of the Aberdeen Engineering Company, is investigating water and has secured the option for mill lot No. 1 from W. J. Smithers, for a site for the proposed electric light and power plant.

ST. CLOUD, MINN.—The Union Power Company contemplates the construction of a power house, long distance transmission lines, and the installation of one more pulp mill, at a total cost of about $350,000.

ST. PAUL, MINN.—The Northwestern Telephone Exchange Company has made application to erect a number of telephone lines in this city.

ARCOLA, MO.—The Kansas City & Springfield Southern Railway Company contemplates building an electric power plant at Arcola. C. C. McFann, of Nevada, Mo., is general manager.

KANSAS CITY, MO.—Arrangements are being made for the installation of additional electric lamps on Walnut Street. The Business Men's League agrees to pay for the ornamental hangers and the city is to pay for the lamps and electricity.

NIXA, MO.—Surveys have been completed for the proposed electric railway from Springfield to Nixa, Mo., and also for the proposed hydro-electric plant on the James River. The plant will be located about 400 ft. above the mouth of the Finley, and will have an output of 1500 hp. Three 36-in. water wheels will be installed. It is stated that if General Standish is successful in obtaining a concession from the Government for a power plant on the White River, the railway will be extended from Nixa to Forsyth and Lead Hill. W. H. Schreiber, civil engineer, is making the surveys.

COLUMBUS, NEB.—The foundations for the engines at the new electric light plant are in and those for the building proper well under way.

KEENE, N. H.—Under the new schedule the maximum price for electricity for lamps charged by the Keene Gas & Electric Company is 16 cents per kw-hour and the minimum price 8 cents per kw-hour; for motors the prices range from 7.5 cents to 2.5 cents per kw-hour. The discount on bills paid before the 10th of the month has been reduced from 20 to 10 per cent. For electricity for lamps a minimum payment of $1 per month will be required for each meter installed, and for power a minimum payment will be required of $1 per month on motors from 1 to ½ hp; above 7½ hp, a charge of 75 cents per hp is made.

ASBURY PARK, N. J.—Bids will be received by the Common Council until Sept. 14 for the privilege of a franchise for a municipal and commercial lighting and furnishing electricity for heating and motors within the city limits of Asbury Park. W. C. Burroughs is city clerk.

CRANFORD, N. J.—The Public Service Corporation has submitted a bid to the Township Committee offering to supply 25-cp incandescent lamps at $18 per lamp per year and arc lamps at $90 each per year.

FREEHOLD, N. J.—The plant and holdings of the Manalapan Light Company were purchased Aug. 19 by W. J. Lansley at auction for $500. The sale was made subject to a bond issue of $25,000 and a mortgage of about $1,500, making the cost of the plant about $27,000. Mr. Lansley was promoter and largest creditor of the company.

PRINCETON, N. J.—Herman Dodd, Vice-President of the Trust Company of America, bought at Master's sale the power plant and electric light lines of the Princeton Light, Heat & Power Company, at Rocky Hill, N. J. The purchase price was $25,000 subject to other incumbrances of $6,000. The company will be reorganized.

ARCADE, N. Y.—George Hogue, president of the board of village trustees, Arcade, N. Y., will call for bids inside of 30 days for 125 tungsten street fixtures equipped with 60-cp lamps.

BATH, N. Y.—C. K. Tower, of Buffalo, one of the promoters of the Citizens' Electric Service Company, of Bath, which has recently been granted permission by the Public Service Commission to build an electric plant in Bath, states that the company will proceed at once to build its power plant and erect transmission lines necessary for the street lighting service.

GENEVA, N. Y.—The special committee appointed by the City Council to investigate the question of establishing a municipal electric lighting plant has requested the City Council to have the city engineer make an estimate of the cost of pole line and other equipment necessary for the distribution of electricity for lighting in order that it may pass intelligently upon various offers it has to furnish electrical energy to a switchboard. It is also stated that the Council will also secure estimates on the cost of a power plant.

CENTERVILLE, N. Y.—An independent telephone company has been organized to install a telephone system in this city, and it is quite probable that the system wil be extended to Fairview. The officers are: V. O. Crowell, secretary; Nelson Huber, treasurer, and J. C. Vosburg, manager.

CHAMPLAIN, N. Y.—The Public Service Commission of the Second District has granted the Champlain & Sanford Railroad Company permission to construct an electric railway 58 miles in length in Essex County. The proposed road will tap the ore mines in the vicinity of Lake Sanford and connect with the Delaware & Hudson Railroad at Riverside.

HUDSON, N. Y.—The Albany & Hudson Railroad Company is planning to make extensive improvements to its power plant at Stuyvesant Falls, which will practically double the output of the plant. The present plans include the installation of a 2000-hp steam turbine, a 500-kw motor generator set, and the erection of a new boiler house, which will involve an expenditure of about $50,000. Raymond H. Smith is general manager.

LEROY, N. Y.—The Board of Water and Light Commissioners of the Village of LeRoy, N. Y., are now considering the renewal of the lighting contract with the LeRoy Hydraulic Electric Gas Company, for a period of five years. It is believed that definite arrangements for the renewal of the contract will be made within the new few weeks.

ROCHESTER, N. Y.—The Central New York Telephone & Telegraph Company has applied for permission to erect telephone lines on certain streets of the city.

MEXICO, N. Y.—The Mexico Electric Company has applied to the Public Service Commission for permission to issue $10,000 in bonds. The present owner of the plant wishes to dispose of his interest in the property to the reorganized company for $15,000. The Commission advised the applicants to organize a new company, with a capitalization of $5,000, and make an application to issue $10,000 in bonds, and if the property could be shown to be worth $15,000, the application to issue $5,000 in stock and $10,000 in bonds would be granted.

WETMORE, N. Y.—The electric light contract which expired with the Wetmore Electric Company for lighting the streets of the village last May has not yet been renewed. The company is still furnishing the electric service. The corporate limits of the village have been extended and the company has been requested to extend its transmission to different parts of the town, but is unwilling to do so unless the Village Board will enter into a five-year contract for street lighting, which it refuses to do, in view of the pending proceedings to acquire the plant of the Wetmore company by condemnation.

ZEBULON, N. C.—Plans are being considered by the Meldrum Chemical & Engineering Company to install an electric light plant and water works system.

MINOT, N. D.—The Minot Telephone Company is planning to extend its telephone lines into Eureka Township.

BUCYRUS, OHIO.—At a meeting of the Board of Public Service on Aug. 20 the bid of the Bucyrus Electric Light & Gas Company is reported to have been rejectd, and the city will, it is said, construct a municipal plant at a cost of $90,000.

CANAL DOVER, OHIO.—The city is considering the question of establishing a municipal electric light plant. Members of the City Council and the Public Service Commission will visit different cities operating municipal plants before letting contracts for the plant.

CLEVELAND, OHIO.—The contract for installing a direct-connected engine in the municipal electric light plant, bids for which were opened Aug. 11, has been awarded to A. L. Ide & Son, of Springfield, Ill., for $1,985.

COLUMUS BARRACKS, OHIO.—Bids will be received until September 10 by Captain H. J. Hirsh, constructing quartermaster, at Columbus Barracks, for furnishing an electric elevator for the hospital at said barracks.

FREMONT, OHIO.—The Fremont Power & Light Company, which was recently granted a franchise by the City Council, has accepted the terms of the franchise and announces that work on the construction of the new plant will begin at once. The company proposes to develop water power in the Sandusky River, and will erect a large power plant in Bayville, south of Fremont.

LIMA, OHIO.—The City Council has passed an ordinance providing for the new $105,000 municipal electric light plant. W. Kesley Schoepf, president of the Lima & Toledo Traction Company, which holds the present street lighting contract, has submitted a third proposition to furnish electricity for street lighting.

PORTSMOUTH, OHIO.—Bids will be received by the Board of Public Service until Sept. 24 for lighting the streets and public places of the city with electricity or other illuminants for a period of three, six or ten years, in accordance with plans and specifications approved by the City Council. Bidders are required to use forms, which will be furnished upon application. George H. Schneider is president of the board.

SPRINGFIELD, OHIO.—Plans are being considered to install a power plant at the City Hospital at once, to cost about $15,000.

WOOSTER, OHIO.—The Board of Public Service has submitted the report giving estimates and plans for the municipal electric light plant, which were prepared by C. E. F. Ahlm, of Cleveland, Ohio, to the City Council.

ZANESVILLE, OHIO.—The promoters of the Central Valley Traction Company are reported to be interested in a proposition to build an electric railway from Zanesville to Duncan Falls and contemplate establishing a large power plant at the last named place.

ASHLAND, ORE.—M. F. Eggleston, City Recorder, writes that Frank C. Kelsey, 415 Corbett Bldg., Portland, Ore., is preparing plans for a power plant to be constructed by the City of Ashland, in Ashland Creek Canyon, to cost about $60,000.

ASTORIA, ORE.—The City Council has granted the Northwestern Long Distance Telephone Company a franchise to install a telephone system in Astoria.

OREGON CITY, ORE.—F. M. Smith, who is backing the project to build an electric railway into the Beaver Creek and Molalla country, has filed notice of appropriation of water from the main channel of the Molalla River. A canal 25 ft. wide and 8 ft. deep wil lbe built to carry the water.

BERLIN, PA.—The citizens on Aug. 11 voted in favor of establishing a municipal electric light plant.

BOYERTOWN, PA.—The site for the Boyertown Electric light plant has been decided upon. The power house will be 40 ft. x 100 ft.

KUTZTOWN, PA.—The Kutztown Rural Telephone Company has applied for a charter. The capital stock is placed at $10,000, and the company is making arrangements to erect telephone lines to Claussville, Cuthsville and several other places.

PHILADELPHIA, PA.—The capital stock of the Standard Gas & Electric Company has been increased from $25,000 to $500,000.

PITTSBURG, PA.—The West Penn Electric Company is planning to make extension to its transmission lines and the construction of more substations. L. H. Conklin is general superintendent.

COLUMBIA, S. C.—The Central Carolina Power Company is said to be making arrangements for commencing the construction of its plant at once, which will include the construction of a dam 30 ft. high, forming, with power house, a structure of 1400 ft. long. The equipment of the power house will include six hydro-electric units, each consisting of four 48-in. turbine wheels direct connected to a 2000 kw. generator. The plant will be located at Turkett Shoals, on Broad River, about 15 miles from Columbia, and will have an output of 15,000 hp., which will be distributed in Columbia, Newberry and Winonboro. The cost of the plant is estimated at $1,850,000. H. L. Milner, of Washington, D. C., is president.

YORKVILLE, S. C.—The Piedmont Telegraph & Telephone Company has made application for a renewal of its franchise, which expires in April, 1908. The company proposes to erect three miles of cables on the streets, make all lines metallic circuit, and make other improvements to its system.

COMFORT, TEX.—Ernest Flach, owner of the local electric light plant, contemplates rebuilding his transmission lines.

CUERO, TEX.—It is reported that contracts have been awarded by the Buchel Electric Company for the reconstruction of its power house, penstocks, etc., for resuming the openation of its hydro-electric plant.

EL PASO, TEX.—It is reported that the Consolidated Telegraph, Telephone & Electric Company has awarded the contract for the construction of a telephone line from Redlands, Cal., to El Paso, Tex., a distance of about 1000 miles, to Charles F. Rolfe, of Redlands, Cal.

FORT WORTH, TEX.—Claiming that the Forth Worth Light & Power Company had failed to comply with the terms of its franchise the City Council of North Fort Worth has taken steps to annul the franchise. The Council claims that the service is inadequate and that in laying mains, etc., the company has fallen short of the requirements of the franchise.

GALVESTON, TEX.—The Brush Electric Light & Power Company is making arrangements to extend its transmission lines to Pier 38 to furnish electricity to operate the plant of the New Orleans Export Company.

SAN ANGELO, TEX.—It is reported that A. Reynolds is interested in a project to build an electric light plant in San Angelo.

SHERMAN, TEX.—The City Council is considering the question of calling an election to vote on the proposition to issue $15,000 in bonds for improvements to the municipal electric light plant.

OGDEN, UTAH.—Plans are being considered by the Ogden Rapid Transit Company to commence work on the extension of its Ogden Canyon line.

SALT LAKE CITY, UTAH.—It is reported that bids will be received until Sept. 4, for constructing the suction gas producer plant. Lewis C. Kelsey, city engr.

AUGUSTA SPRINGS, VA.—The Augusta Springs Tanning Company has awarded the contract for wiring and installing an electric light plant in its tannery to Snyder & Sheets, of Staunton, Va.

CLINTWOOD, VA.—The Wise Telephone Company & Telegraph Company contemplates making many extensions to its system and also to rebuild the telephone line between Coeburn and Clintwood.

CHENEY, WASH.—The Cheney Light & Power Company is extending its transmission lines in Normal Park and Reservoir additions to furnish the residents of those sections with electricity for lamps and motors.

ELLENSBURG, WASH.—Devarney, Morgan & Company, of Portland, Ore., have made application for a franchise to install a telephone system in Ellensburg.

KETTLE FALLS, WASH.—The Farm & City Telephone Company has applied for a franchise to erect telephone lines over the roads in Columbia County.

PASCO, WASH.—Plans are being considered by the Pasco Light & Water Company for the construction of a new plant.

PASCO, WASH.—The power plant of the Northern Pacific Light & Power Company was destroyed by fire on Aug. 7, causing a loss of about $51,000.

SEATTLE, WASH.—The Seattle Electric Company has been awarded the contract for furnishing electricity for lamps and motors for the Alaska-Yukon Exposition.

SEATTLE, WASH.—According to the estimate furnished by L. B. Young, superintendent of the light and water department, over $500,000 will be required to finish the construction and extension of the municipal lighting plant. Bonds will be issued secured by the revenues from the lighting plant to raise the money. There has been already issued $1,440,000 in lighting bonds and with the amount proposed to be issued the total capitalization of the plant will be about $2,000,000.

BETHANY, W. VA.—The Tri-State Traction Company has applied to the City Council for a franchise to operate its cars on certain streets in the city.

OAKVALE, W. VA.—The Oakvale Telephone Company is making arrangements to install a telephone system in Mercer County.

DODGEVILLE, WIS.—The Dodgeville Electric Light & Power Company has been granted permission to erect an electric plant on the railroad land just south of the Illinois Central passenger depot. The company will erect a new building. It is expected that an ice and heating plant will be operated in connection with the new plant. The city will take possession of its buildings and boilers used by the Dodgeville Electric Light & Power Company, the ten years' franchise held by the company having expired.

GLENWOOD, WIS.—The West Wisconsin Telephone Company has started work on the construction of 20 miles of new line in the towns of Emerado and Cylon.

KAUKAUNA, WIS.—Work will commence immediately on the construction of a large dam across the Fox River for the Green Bay & Mississippi Canal Company. The dam will be nearly 3500 ft. in length with a 28-ft. head and will develop 3000 hp. The power house is nearly completed, and it is expected to put the plant in operation about Sept. 15, when all of the mills on the upper power will be operated by electricity instead of water power, except those on the Mead and Edwards Canal and the Outagamie Paper Company.

MAYVILLE, WIS.—The Northwestern Iron Company is remodeling its power plant at Mayville, and is installing alternating-current equipment to supply electrical energy for the furnace plant, its iron mines at Nye, Wis., and to the city of Mayville. The plant is steam driven and furnace gases now going to waste will be used. A. G. McKee is consulting engineer.

MONROE, WIS.—The Monroe & Washington Telephone Company has been organized to erect telephone lines into the surrounding country.

OSHKOSH, WIS.—All of the property and holdings of the Winnebago Traction Company has been purchased by Oliver C. Fuller, Fred C. Best and Russell, all of Milwaukee, Wis., under foreclosure proceedings, for $950,000. It is proposed to reorganize the company with Clement C. Smith, of Milwaukee, as president. It is said an association of interests of the traction company and the Eastern Wisconsin Railway & Light Company will be formed within a short time. The extension of the Omro interurban railway to Berlin is practically assured. J. P. Pullman, the present superintendent, has ben appointed general manager.

EDMONTON, ALB., CAN.—The city has purchased the 33-year franchise of the Strathcona Radial Tramway Company.

EDMONTON, ALB., CAN.—The City Council is now making arrangements for the construction of an electric street railway system to run here and in the City of Strathcona on the opposite side of the Saskatchewan River. Edmonton has secured the charter of the Strathcona Radial Tramway Company. Arrangements provide for the building of a small system this summer which will be materially extended next year. Address Mayor Macdougall.

WETASKIWIN, ALB., CAN.—The ratepayers have voted $12,000 for improvements to the municipal electric lighting plant. Address Mayor McKay.

LAC DU BONNET, MAN., CAN.—The Winnipeg Electric Company has a large gang of men at work enlarging the channel here to increase the water power of its electrical development plant. An engineer estimates that fully 100,000 hp can be developed on the river here. This energy is used to operate the company's cars and also supply Winnipeg with electricity.

WINNIPEG, MAN., CAN.—It has been decided to no longer delay the scheme for the development of power at Lac du Bonnet and Controller Evans has been instructed by the City Council to find the necessary money by the sale of debentures. Cecil B. Smith, chief engineer.

BRANTFORD, ONT., CAN.—The Cataract Power Company, of Hamilton, has submitted a proposition to the City Council offering to renew its offer to supply electrical energy to the city at a cost guaranteed 10 per cent less than the Hydro-Electric Commission would furnish it. The company also agrees to furnish arc lamps at $52.50 each per year.

COLD SPRINGS, ONT., CAN.—Plans are being made to extend the telephone lines of the Hamilton Township Rural Telephone Company into Northumberland County.

DUNNVILLE, ONT., CAN.—The ratepayers have voted in favor of taking $39,000 in bonds of the electric railway company now being organized to cross the Niagara Peninsula from this town to Beamsville. Address James A. Ross, Wellandport, Ont.

LETHBRIDGE, ONT., CAN.—We are informed that this city has purchased the plant of the Lethbridge Electric Company, and will take possession of same on Sept. 1. It will be removed to another site; will be changed from simple to condensing; the improvements include new boilers and central station, new 300-kw steam turbine or engine set. Arthur Reid, superintendent, Lethbridge.

TORONTO, ONT., CAN.—The Board of Control has appointed Kenneth L. Aitken as electrical engineer to take charge of constructing the electrical distributing plant for the city.

TORONTO, ONT., CAN.—The F. H. McGuigan Construction Company has been awarded the contract by the provincial government for building 293 miles of transmission lines for $1,270,000. The company has offered to build another 293 miles at the same rate providing the government notifies it before February 1, 1909. This tender was $250,000 less than the government estimate and $500,000 less than the highest tender.

WINGHAM, ONT., CAN.—The Town Council is reported to have awarded contract for new machinery for the electric light plant to the Canadian General Electric Company, of Toronto, for $4,350.

MONTREAL, QUE., CAN.—The Montreal Light, Heat & Power Company submitted an offer to the City Council offering to make a ten-year contract for the lighting of the city at $75 per arc lamp per year. The company under the present contract receives only $60 per lamp per year.

New Industrial Companies.

THE NATIONAL INSULITE COMPANY, of Aurora, Ill., has been chartered, with a capital stock of $25,000, by A. H. Mikesell, A. M. Scott and John K. Newhall.

THE SOUTHERN LIGHT IMPROVEMENT COMPANY, of Atlanta, Ga., has been incorporated, with a capital stock of $10,000, by Frank S. Westbrook, Charles L. Van Noppen and C. E. Bullock.

THE BOSTON GAS PRODUCER & ENGINE COMPANY, of Cambridge, Mass., has filed articles of incorporation, with a capital stock of $100,000, for the purpose of manufacturing engines. F. F. Stockwell, of Somerville, is president and treasurer.

THE MELDRUM CHEMICAL & ENGINEERING COMPANY, of Zebulon, N. C., has been incorporated with a capital stock of $50,000, by Archibald Meldrum and others. The company will do a general engineering business, succeeding Mr. Meldrum, and will build a machine shop and chemical laboratory.

THE INTERNATIONAL ELECTRIC LABORATORIES, of Boston, Mass., has been incorporated with a capital stock of $100,000 and the following officers: Thomas H. Sherman, of Brookline, Mass., president; John H. Stone, of Brookline, treasurer, and Frank V. Stone, of Newton Highlands, Mass., treasurer.

THE ELECTRIC AUTOMATIC MACHINE COMPANY, of Pittsburg, Pa., has filed articles of incorporation at Wilmington, Del. The company is capitalized at $100,000, and the incorporators are: R. R. McElhaney, H. K. Beegie, M. E. Johnson, all of Pittsburg, and George D. McMorran, of Bakerstown, Pa.

THE OGDEN ELECTRIC SUPPLY COMPANY, Ogden, Utah, has been chartered with a capital stock of $10,000, and proposes to do a general business in electric fixtures and supplies. The officers are: Charles A. Halverson, president; George Halverson, vice-president; Lawrence Herdti, secretary and treasurer.

THE GERMANIA ELECTRIC HEATING & MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 and the following named directors: Frank Vernon, George Fritz, of New York, N. Y., and Fred W. Kristellar, of Brooklyn, N. Y. The company proposes to manufacture electric flat irons, electric cigar lighters, etc.

THE NATIONAL MACHINE RECORDER COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $110,000, to manufacture and sell a machine which automatically and accurately records every working and idle moment of each and every machine in a shop. The directors of the company are: James F. Broderick, George E. White, T. J. Hyman, Marcus A. Kavanaugh, A. H. Swett, Fred Kurtz, of Rockford, Ill. P. A. Cooney is president.

Company Elections.

CLEVELAND, OHIO.—At the annual meeting of the Massillon, Wooster & Mansfield Traction Company the following named officers were elected: G. A. Bartholomew, president and general manager; J. W. Buchanan, vice-president; R. I. Guthman, secretary, and H. G. Bye,

treasurer. The company is building an electric railway from Mansfield to Massillon, via Wooster, with branches to Ashland, Turkey Foot Lake and Barberton. The company is capitalized at $1,000,000.

New Incorporations.

TUSCALOOSA, ALA.—The City Electric Company has been incorporated with a capital stock of $5,000, by Arthur Laycock, J. F. Alston, W. T. Ozement and Eugene Baetty.

PHOENIX, ARIZ.—Articles of incorporation have been filed for the People's Independent Telephone Company. The company is capitalized at $100,000 and the directors are M. A. Stanford, J. H. Langstron and A. Schreck.

CORTEZ, CAL.—The Montezuma County Telephone Company has been incorporated, with a capital stock of $15,000, by P. T. Guilett, H. Brigham and R. R. Smith.

MODESTO, CAL.—The Ceres Telephone Company has been incorporated with a capital stock of $10,500 by J. F. Campbell and S. E. Foster, of Modesto; Anthony Morgan, M. E. Taylor and J. B. Tapper, of Ceres.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Kaweah-Southern Power Company. The capitalization is $2,500,000, of which $500 is paid in. O. E. Hotle, of Oakland, is said to be interested, and the directors are: R. W. Kittrelle, W. Gabriell, C. F. Watson, A. H. Dale and R. McHenry.

WASHINGTON, IND.—The Acme Electric Company of this city has filed articles of incorporation. The company proposes to manufacture, buy and sell electrical equipment of all kinds. R. W. Eves, E. M. Robertson and John Lundergan, directors.

CHANUTE, KAN.—Th Chanute Electric Railway Company has been organized. The officers are: W. M. Gray, president; J. M. Massey, vice-president; S. W. Brewster, secretary, and D. M. Kennedy, treasurer.

LACKEY, KY.—The Lackey-Hartley Telephone Company has been organized with a capital stock of $1,000 by Adam Miller, H. H. Taylor and R. L. Hartt, who has been appointed manager of the company. The company proposes to erect about 30 miles of telephone lines.

LEBANON, KY.—The Lebanon Home Telephone Company has been chartered, with a capital stock of $7,500, by T. M. Estes, J. A. Kelly, R. Heuge, Edelen, R. G. Goodwin, J. M. Rains, W. E. Mattingly and J. A. Smith, all of Lebanon.

SOMERSET, KY.—The Somerset & Level Green Telephone Company has filed articles of incorporation with a capital stock of $300. The incorporators are: Nathan Buchanan, W. F. Hansford, W. J. Brinkley, James T. Frenen and G. M. Crouch.

BOSTON, MASS.—Articles of incorporation have been filed for the Electric Underground Trolley Railway Company. The capital stock is placed at $50,000, and the following officers have been elected: G. N. G. Holman, of Boston, president; Cora B. Oyling, of Malden, Mass., treasurer and clerk.

HOUGHTON, MICH.—The Houghton County Traction Company has been organized for the purpose of operating the Mohawk extension, and it is said that the company plans to take over the entire system of the Houghton County Street Railway Company.

MINNEAPOLIS, MINN.—Articles of incorporation have been filed for the Electric Short Line Railroad Company by Severen Solverson, of Minneapolis, president; E. C. Hinde, of Sioux Falls, S. D., vice-president; Frank E. Reed, of Glencoe, secretary.

PLUMMER, MINN.—The Clearwater Farmers' Telephone Company has been incorporated with a capital stock of $10,000 to construct a telephone system in Plummer and throughout Red Lake County.

AURORA, NEB.—Articles of incorporation have been filed for the Aurora Electric Company, with a capital stock of $35,000, by M. E. Pense, Louis A. Enderle and others.

CENTERVILLE, N. Y.—A new telephone company has been formed at Centerville, N. Y., with J. C. Vosburg, manager; V. O. Crowell, secretary, and Nelson Hauber, treasurer. The primary object of the formation of the new company was the erecting of a line extending from the post office to the B. & S. railroad station, little more than a mile distant, but it has now been decided to extend the line to Fairview and connect with the inter-ocean line at Rushford and spread the system to the entire comunity.

CLEVELAND, OHIO.—The International Independent Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: C. Y. McVey, W. H. Hillhouse, J. C. Boush, W. H. Sheppard and W. E. Cary, Jr.

CUMBERLAND, OHIO.—Articles of incorporation have been filed for the Buffalo Valley Telephone Company by T. M. Hathaway, Cary McLelland, C. A. Turner, F. M. Frisbee, J. D. Collins, Harry McCracken and others.

CHICHASHA, OKLA.—Articles of incorporation have been filed for the Public Service Company by Thurman H. Williams and Alphonso C. Crose, of Chichasha, and C. Townsend Blake, of Trenton, N. J.

DUKE, OKLA.—The People's Telephone Exchange Company has been incorporated with a capital stock of $20,000 by G. C. White, T. W. Alexander, J. H. Peters and others.

NARDIN, OKLA.—Articles of incorporation have been filed for the Nardin Mutual Telephone Company by S. Congram, Thomas Cassidy and C. H. Tolle.

ALBANY, ORE.—Articles of incorporation were filed for the Lebanon Electric Light & Water Company, which will henceforth own and operate the light plant and water system in Lebanon. The incorporators are: S. P. Bach, Samuel M. Garland, J. C. Mayer, P. M. Scroggins and S. I. Stewart. All of the incorporators except Mr. Stewart are residents of Lebanon.

ASTORIA, ORE.—Articles of incorporation have been filed for the Astoria Automatic Telephone Company by George E. Waggoner, J. H. Whyte and G. C. Fulton. The company is capitalized at $100,000 and proposes to install a telephone system in Astoria, for which a franchise has been granted by the City Council. A long-distance telephone line between Astoria and Portland is also to be erected.

ARKADELPHIA, PA.—The Arkadelphia Electric Light Company has been organized and has purchased the electric light plant of the Wilson Water & Light Company, of Arkadelphia. The new company will operate the lighting and power business, while Mr. Wilson will retain the water works plant. The officers of the electric company are: J. W. Winburne, president; H. S. Hartzog, vice-president; T. A. Tennison, secretary, and N. D. Hule, treasurer.

CLEARFIELD, PA.—Application will soon be made by the Dimeling Light & Power Company for a charter for the purpose of supplying electricity in Clearfield and vicinity for lamps and motors. H. A. Kennedy, J. P. Laughlin and H. S. Whiteman, Jr., are interested in the project.

SCRANTON, PA.—The Keen's Pond & Steene Telephone Company has been organized to construct a telephone system, work on which will commence at once.

WYOMING, PA.—The Citizens' Electric Company has been incorporated with a capital stock of $5,000 and the following directors: M. W. Stroud, treasurer; C. H. Riggin, Joseph A. Slattery, all of Philadelphia, Pa.

COOKEVILLE, TENN.—The Cookeville Home Telephone Company has been organized to install an exchange in Cookeville and erect telephone lines throughout Putnam County. T. L. Denny, Griffin Smith and J. R. Douglas are interested in the enterprise.

WOODLAWN, TENN.—The Woodlawn Independent Telephone Company has been organized by the citizens of Woodlawn, and is erecting a telephone line from this town to Brownsville. Other extensions are contemplated.

MOAB, UTAH.—The La Sal Mt. Telephone Company & Electric Company has been organized and the following officers elected: D. L. Goudelock, of Carlisle, president; D. M. Cooper, of Moab, secretary, and W. J. Meadow, manager.

PUYALLUP, WASH.—The Puyallup Valley Home Telephone Company has filed articles of incorporation, with a capital stock of $80,000. The incorporators are P. W. Milburn, George B. Woodbridge and James A. Colby, all of Tacoma.

TACOMA, WASH.—The Narrows Terminal Belt Line Railway Company has been incorporated with a capital stock of $250,000 to construct an electric railway from Tacoma to Belmarlow Beach. The company proposes to construct a power plant near American Lake, for which water rights have been filed, appropriating 2000 cu. ft. of water per second from the lake. The incorporators are: Lucien F. Cook, Henry L. Gray, Charles E. Cutter, C. A. Thomson and Fred S. Cook.

BELOIT, WIS.—The South Beloit Water, Gas & Electric Company has been organized in South Beloit.

DARLINGTON, WIS.—The Rural Telephone Company has been incorporated with a capital stock of $1,500 by R. F. Lancaster, Henry McPhillips, John Kilkelly and others.

DURAND, WIS.—Articles of incorporation have been filed for the Home Telephone Company, of Durand, with a capital stock of $12,000, by W. E. Plummer, George Tarrant, A. J. Wallace, Frank Pierce and others.

GREEN LAKE, WIS.—The Green Lake Rural Telephone Company has been organized. The officers of the company are: R. H. Buckland, president; H. H. James, vice-president; Byron Chapel, secretary, and George Thrasher, treasurer.

JANESVILLE, WIS.—The Cincinnati Construction Company has been incorporated with a capital stock of $25,000 to construct an electric interurban railway between Janesville and Madison. The incorporators are: J. M. Bostock, M. P. Richardson, Archie Reid, P. H. Korst, Richard Valentine and H. H. Zigler, all of Janesville.

LUCK, WIS.—The Equity Telephone Company has been incorporated with a capital stock of $5,000 by John B. Peterson, E. M. Wilson and J. R. Murphy.

MILWAUKEE, WIS.—Articles of incorporation have been filed for the Newton & Osman Telephone Company, of Liberty. The capital stock of the company is placed at $2,500, and the incorporators are John Dunbar, T. J. Walsh and D. Grady.

MADISON, WIS.—The McKinley Telephone Company, of McKinley, has been incorporated, with a capital stock of $1,500, by E. J. Pfluger, Anton Lundmark and Oscar Risberg.

MARATHON, WIS.—The Marathon-Zeigler Telephone Company has been incorporated with a capital stock of $1,800 by J. Barber, J. G. King and Martin Gilman.

MILLTOWN, WIS.—The Milltown Mutual Telephone Company has been organized with a capital stock of $4,000 by John N. Rahr, Mads Bank, Simon K. Twentten and George E. Peterson.

MINOCQUA, WIS.—The Minocqua Telephone Company has filed articles of incorporation with a capital stock of $8,000. The incorporators are: A. O. Dorwin, D. A. Kahns, A. Jay Bolger, F. W. Rogers, W. H. Bissell, S. B. Bissell and others.

OSHKOSH, WIS.—The Wisconsin Electric Railway Company has filed articles of incorporation with the Secretary of State. The company proposes to purchase the property of the Winnebago Traction Company. The incorporators are: O. C. Fuller, Fred Best and Russell L. Smith.

WAYSIDE, WIS.—The Wayside Telephone Company has been incorporated, with a capital stock of $2,000, by Joseph Hoffman, Thomas Monahan and John Matzke.

WEST ALLIS, WIS.—Articles of incorporation have been filed for the West Allis Light & Power Company by Henry G. Meigs, John B. Meigs and F. C. Weed. The company is capitalized at $10,000 and proposes to furnish gas and electricity in West Allis. The company has already applied for a franchise in this city.

LACOMBE, ALB., CAN.—The Blindman River Electric Power Company contemplates installing an auxiliary steam plant. E. J. Tett is manager.

CRESTON, B. C., CAN.—The Creston Power, Light & Telephone Company has been incorporated, with a capital stock of $20,000, and the following officers elected: George M. Benney, president; James Compton, vice-president; Guy Lowenberg, secretary and treasurer.

COLD SPRINGS, ONT., CAN.—The lines of the Hamilton Township Rural Telephone Company, which has recently established connections with Cobourg, are to be extended in Northumberland County.

HARRISTON, ONT., CAN.—Articles of incorporation have been filed for the Minto Rural Telephone Company, with a capital stock of $10,000. The principal office will be located in Harriston.

KINTORE, ONT., CAN.—The Missouri Telephone Company has been incorporated with a capital stock of $15,000 by D. McMillan, W. I. Hogg, W. H. McGee and others.

MULL, ONT., CAN.—The Farmers' Long Distance Telephone Company has been organized with a capital stock of $40,000. The company is a consolidation of two local companies, and is planning much new construction work. The officers of the company are as follows: Neill Watson, of Mull, president; James Rutherford, of Blenheim, vice-president, and L. Edmunds, of Blenheim, secretary.

TORONTO, ONT., CAN.—The Interurban Electric Company, Ltd., has been incorporated to operate in the municipalities of West Toronto, Township of York, Toronto; Township of Etobicoke, and the Township of Toronto. The company is authorized to operate steam and electric railways, telephone systems and to generate electricity for lamps, heat and motors. It also has authority to purchase or take over the Stark Telephone, Light & Power System, Ltd. The company is capitalized at $400,000, and the directors are: Eli Smith Edmanson, Fred Grundy, Alfred Neville Morine, Mervil McDonald, Charles Herbert Porter, George Deleno Lewis and George T. Turnbull.

WHEATLEY, ONT., CAN.—The Wheatley Telephone Company has been chartered, with a capital stock of $20,000, and the following-named directors elected: F. J. Fox, N. Coles, Oscar Lounsbury, Robert Goodison, J. H. Allen, J. A. Campbell and A. M. Wilson.

Legal.

BATAVIA LIGHT & POWER COMPANY IN RECEIVER'S HANDS.—Seth W. Warren, of Buffalo, N. Y., has been appointed permanent receiver of the Batavia Light & Power Company, to wind up the affairs of the company, which has furnished gas and electricity in Batavia for over 50 years.

Personal.

MR. E. S. FREEMAN, of the Arnold Company, addressed the Chicago Electric Club August 26 on the subject "Irrigation and Power Development in the West."

MR. ROBERT W. ADAMS for some time past assistant to the general manager of the D. & W. Fuse Company, Providence, R. I., has joined the engineering staff of the General Electric Company at Pittsfield, Mass.

MR. JOHN J. GAFFNEY, superintendent of the electrical department, Public Service Corporation of New Jersey, at Newark, N. J., for the past 23 years, has been appointed to the position of electrical inspector for the city of Newark. Mr. Gaffney is one of the pioneers in the business, having entered it in the early days with Dr. Edward Weston in 1876.

DR. WILLIAM F. SCHULTZ, who for the past five years has been instructor in physics at the University of Illinois, has been promoted to the position of assistant professor of physics. Dr. Schultz was graduated from the Baltimore Polytechnic School in 1890, and in 1893 was an honor man of Johns Hopkins University, from which he received the degree of Ph.D. the present year. He has also received the degree of B.S. from the University of Illinois.

PROF. F. D. CRAWSHAW has been appointed assistant to the Dean of University of Illinois College of Engineering. Prof. Crawshaw is a graduate of Worcester Polytechnic Institute, class of 1896, and has been in charge of the manual training department of Minneapolis Central High School, assistant at the Bradley Polytechnic Institute and principal of the Peoria Franklin School.

MR. CHARLES S. POWELL, formerly of the Westinghouse interests, and whose offices are at 165 Broadway, New York, has just returned from a trip through the South in connection with some engineering work which his firm is carrying out. Mr. Powell reports that the business conditions in the South are very cheerful and an optimistic tone is present everywhere. In Jacksonville, Fla., particularly the citizens are very proud of the fact that during the recent stringency the city banks were able to meet the situation without recourse to clearing-house certificates. Jacksonville is one of the growing cities of the New South, and with the opening of the Panama Canal will be one of the most important ports on the Atlantic.

Obituary.

MR. GEORGE M. BURPEE, electrical engineer of the Manchester (N. H.) Traction, Light & Power Company, died suddenly on a train when traveling with his wife between Manchester and Boston on the morning of August 24. Mr. Burpee was 44 years old, and lived at Manchester.

DR. W. M. HABIRSHAW.—Note was made last week of the death of Dr. W. M. Habirshaw, president of the Habirshaw Wire Company, New York. The funeral was held at St. Thomas' Church, Fifth Avenue, on August 19 and was largely attended, while the floral tributes were beautiful and numerous. The pall bearers were: H. B. Thayer, vice-president, Western Electric Company; M. J. O'Brien, president, Southern Express Company; C. R. Huntley, president, Buffalo General Electric Company; Chas. W. Price, president, Electrical Review Publishing Company; John W. Lieb, Jr., past president, American Institute of Electrical Engineers; T. C. Martin, editor, ELECTRICAL WORLD; Philip Torchio, chief engineer, New York Edison Company; W. Hollister, L. Kountze & Company, bankers. The Habirshaw Company was represented by R. Irvin, first vice-president; R. S. Satterlee, second vice-president; F. J. Hall, treasurer; J. B. Olson, secretary; A. Starke, auditor, and W. W. Thom, superintendent. There were also present all the employees of the company at the factory and in the sales department, and a great many personal friends in the business and professional world. Telegrams of condolence were received from Samuel Insull, president of the Chicago Edison Company, and J. E. Montague, president Niagara Falls Light & Power Company. After the funeral the remains of Dr. Habirshaw were cremated at Fresh Pond, L. I., and following the request he had made, the ashes were strewn over the grave of his son William at Woodlawn Cemetery.

Trade Publications.

PANEL BOXES and ground clamps are entertainingly dealt with in Bulletin No. 57 of the H. T. Paiste Company, Philadelphia.

ENAMELED REFLECTORS of the prismatic type are discussed in a publication issued by the Holophane Company, 227 Fulton St., New York.

ELECTRICALLY-DRIVEN SWING SAWS for wood-working establishments are treated in Bulletin No. 101 of Carse Brothers Company, 165 Broadway, New York.

CONTROLLING DEVICES for direct-current and alternating-current circuits are listed, described and well illustrated in a loose-leaf catalog issued by the Sundh Electric Company, New York.

MOTOR-DRIVEN ORGAN BLOWERS, constructed with particular reference to noiseless operation, are described in a bulletin issued by the Kinetic Engineering Company, Baltimore Avenue and Sixteenth Street, Philadelphia.

ELECTRICAL SECURITIES.—"Negotiable" and "real" securities are the titles of publications relating to its "Security" apparatus recently issued by the F. Bissell Company, Toledo, Ohio. The devices described include pole-distributing rings, cam-tops, fuses, panels, pole-rests, pot-heads, manhole guards, time-switches, automatic hand-lamps and sign-flashers.

BORING MILLS.—The Niles-Bement-Pond Company, 111 Broadway, New York, has issued a handsome catalog containing numerous illustrations and brief descriptions of boring and turning mills. With almost no exception these machines are arranged for motor drive, special attention having been paid to the relation of the type of motor, its location on the machine and its connection to the driven members.

BALL BEARINGS.—A striking illustration of the advantages attending the use of ball bearings with electric motors is afforded by sheet 22 issued by the Hess-Bright Mfg. Company, Philadelphia, which shows that a saving of $5.32 per year may be obtained on a 2-hp motor by reason of the decrease in expense for energy consumed. A complete illustrated technical description of ball bearings is given in a neatly illustrated general catalog recently issued by the company.

TRIPLE-VALVE.—Instruction Pamphlet No. 5034 of the Westinghouse Air Brake Co., Pittsburg, Pa., deals in great detail with the triple-valve used in air-brake equipments.

SWITCHBOARDS of the direct-current type for 125-volt and 250-volt service in isolated and central station plants are listed and described in Bulletin No. 19 of the F. Bissell Company, Toledo, Ohio.

VENTILATING BLOWERS.—The American Blower Company, Detroit, Mich., has issued an exceptionally well illustrated catalog giving technical descriptions of ventilating blower equipments of various steam and electric railroads.

ELECTRIC FURNACE BLOWERS arranged for receiving energy for alternating or direct-current circuits are fully described in a well-prepared bulletin, designated as No. 3306, issued by the Emerson Electric Mfg. Co., St. Louis, Mo.

MOTOR-DRIVEN CLOTH-CUTTING MACHINES are illustrated and described in a neat publication of the Eastman Machine Company, Buffalo, N. Y. A list is given of fully 600 manufacturers who have bought and are using these machines.

ELECTRIC SUCTION SWEEPER.—The Electric Suction Sweeper Company, of New Berlin, Ohio, illustrates and describes in a neat pamphlet, an interesting type of sweeper and cleaner. Unlike most forms of electric carpet sweepers, the one shown can also be used by means of several attachments, for cleaning upholstering, cushions, walls, etc.

ELECTRIC FLAT-IRONS.—An unusual and effective demonstration of the performance of its flat-iron is given in a publication entitled "Hot Points," issued by the Pacific Electric Heating Company, Ontario, Cal. A "scorch" on an insert shows an actual impression made by a Pacific electric iron when allowed to rest on the paper for about 10 seconds. A prominent feature of this iron is the hot point, which is advantageous in pressing damp goods.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., are distributing an attractive folder, entitled "'Tis of the Home We Speak," the circular being devoted to a well-written description of their new lighting fixtures, manufactured by the Price-McKinlock Company, Boston, Mass. The circular should be found of considerable interest to architects or those contemplating installation of attractive lighting fixtures. Especial attention is called to the new studios at 264-270 Fifth Avenue, Chicago, where a large number of original designs in fixture lightings are shown.

SMALL PLANT SWITCHBOARD PANELS.—Bulletin No. 4610, just being issued by the General Electric Company, Schenectady, N. Y., describes its new line of small plant, continuous current switchboards. These boards are manufactured for 125 and 250 volt circuits only, and each panel forms a separate and complete switchboard not intended for combination with other panels. They are made to control one generator and two feeder circuits, and additional feeder switches cannot be furnished. The panels are made of natural black slate and are supported by 1-in. gas pipe supports. A full description with sizes and weights of various panels is contained in the bulletin.

Business Note.

THE SCHAEFFER & BUDENBERG MANUFACTURING COMPANY announces that it has sold its factory buildings at Foxboro, Mass., and that on September 1 will move its main office, works and New York salesroom to 963-5 Kent Avenue, Brooklyn, N. Y.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 18, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

896,081. TELEPHONE CALL-REGISTER; Byron B. Brockway, Cleveland, Ohio. App. filed March 30, 1906. A call register for a telephone system carried in and secured to a transmitter shell so as to communicate directly with the back of a diaphragm, and a member permanently secured to such register extending through such shell, adapted to operate such register, substantially as described.

896,092. ELASTIC SUSPENSION FOR THE FILAMENTS OF ELECTRIC INCANDESCENT LAMPS; Paul Druseidt, Remscheid, Germany. App. filed April 16, 1908. In an electric filament lamp, an internal rigid filament carrier, a rigid filament holder supported thereby by an elastic supporting means and filaments carried by said filament holder and connected with the filament carrier by coiled conducting wires.

896,103. TELEPHONE SYSTEM; Charles L. Goodrum, Philadelphia, Pa. App. filed July 31, 1903. Details of cord and signal circuits of exchange system.

896,122. PLURAL LAMP SOCKET; Edward A. LeFebre, Jr., Brooklyn, N. Y. App. filed Aug. 28, 1907. Has an annular insulating base with a pair of conical cups depending therefrom, the exterior of which has a plurality of threaded shells and the interior of which constitutes a common central terminal. The interior cup is slotted to give a certain resiiiency to the center contacts.

896,130. RECEIVER FOR WIRELESS TELEGRAPHY; Guglielmo Marconi, London, England. App. filed March 13, 1907. In a receiving apparatus for wireless telegraphy, the combination with an oscillatory circuit, of an oscillation valve, an induction coil and a condenser, said valve, condenser and the primary winding of the induction coil being connected in series and operatively connected with said oscillatory circuit, and a detecting device connected with the secondary winding of said induction coil.

896,144. ELECTRODE; Harry Pauling, Kelsenkirchen, Germany. App. filed Aug. 13, 1906. A process of treating gases by arc discharges consisting in producing melted metal oxids at the points of the electrodes made of a metal generating the melted oxids by the action of the energy supplied to the electrodes used for the production of the arcs, and in maintaining such melted oxids in their liquid state by the said arcs.

896,173. TELEPHONE APPARATUS; James H. Thompson, Trenton, N. J. App. filed Dec. 30, 1907. The combination in a telephone apparatus, of a bell-box, wires connected with the bell-box and adapted to be connected with a desk set or the like, and a device having sections arranged to receive the wires between them and to guide said wires and also having a drum and a spring connected with the drum; the drum comprising a body and a portion detachably connected with the body and arranged to hold the wires to the body, and the spring being arranged to be put under tension by the drawing of the wires off the drum and also arranged when the pull on the wires is released to rotate the drum and thereby take up slack of the wires.

896,182. CONDUIT ROD; Richard H. Villard, New York, N. Y. App. filed April 10, 1908. A coupling rod for use in threading conduits and having joints analogous to the clasp couplings of an air brake hose. Wheels are provided at the joints to facilitate pushing the rod through the conduit.

896,184. APPARATUS FOR THE ELECTROLYSIS OF FLUIDS; Emil Weichert, Augsburg, German. App. filed Oct. 24, 1906. Includes a tank in which is received a specially constructed receptacle having tubular passages which depend from its body portion into the tank.

896,188. SYSTEM FOR STORAGE BATTERY CONTROL; Edward Wray, Janesville, Wis. App. filed Nov. 20, 1906. A means whereby a storage battery may be charged from an intermittent or variable moving generator such as a car axle. Provides means whereby the generator is disengaged from the battery during such intervals as would not result in a useful current, and is disengaged when the battery reaches full charge as indicated by an integrating meter.

896,189. ELECTRIC TROLLEY; John Young, Toledo, Ohio. App. filed April 29, 1908. The trolley wheel is inclosed in a semi-circular trough which guides it in its rotation, the wheel being supported by a pair of rollers engaging an interior annular surface thereof.

896,192. TERMINAL PIECE FOR ELECTRIC CIRCUIT BREAKERS; Christian Aalborg, Wilkinsburg, Pa. App. filed May 2, 1906. A plug having a plurality of radially slotted luminæ surrounding a tapered recess and adapted to make an electrical connection in addition to that established by the central plug proper.

896,198. TROLLEY POLE; Lawrence C. Collins and Arthur R. Eltom, Cranford, N. J. App. filed Feb. 28, 1908. Patentee has a supplemental trolley wheel mounted on a forked hinge on the usual harp and adapted to be elevated to guide the usual wheel onto the trolley conductor.

896,200. BRANCH CONNECTION FOR ELECTRIC CABLES; John J. Dossert, New York, N. Y. App. filed March 7, 1904. A connection analogous in form to an ordinary pipe fitting tee and which has two parts which are screwed together to impress the conductor in a vise-like grip to establish good branch connections.

896,210. CONTACT MEMBER; Henry D. James, Pittsburg, Pa. App. filed May 16, 1906. A terminal plug having a plurality of annularly arranged spring blades in addition to the central plug proper and which are deflected into a taper socket outlined to engage a corresponding coned contact member.

896,216. ELECTRICALLY PROPELLED VEHICLE; Louis Krieger, Paris, France. App. filed Jan. 10, 1906. The combination with a generator of constant watts, of a motor arranged to be energized by said generator, said motor having a diamagnetic winding also energized by said generator.

896,217. WINDING FOR SINGLE-PHASE INDUCTION MOTORS; Fred R. Kunkel, Edgewood Park, Pa. App. filed Dec. 3, 1906. In an electric motor, the combination with a main winding having two sections adapted to be connected in either series of parallel relation, of an auxiliary winding adapted to be connected in parallel relation to only one section of the main winding when the sections are connected in series with each other.

896,218. ELECTRIC WELDING MACHINE; Laurence S. Lachman, New York, N. Y. App. filed Aug. 6, 1906. The machine has a pair of co-acting dies which serve to engage a pair of sheet metal surfaces into contact through a limited area. The dies are made the terminals of an electric circuit.

896,220. ELECTRIC LOCOMOTIVE; Benjamin G. Lamme and Norman W. Storer, Pittsburg, Pa. App. filed January 5, 1907. A resilient means for engaging the armature of a generator to the driving shaft of a locomotive. Includes springs having alternately large and small convolutions and which are received in annular recesses between the driving and the driven members.

896,225. MEANS FOR AUTOMATICALLY RESTORING A TROLLEY WHEEL TO THE WIRE; Charles F. Mehl, of Cleveland, Ohio. App. filed Sept. 18, 1907. Patentee mounts a supplemental sliding section on the usual trolley pole and which carries a special trolley wheel adapted to be impelled upward to guide the usual wheel on the wire by means of a solenoid magnet.

896,227. MEANS FOR REGULATING THE SUPPLY OF ELECTRIC CURRENTS; Charles Maurice Philippe Montbardon, Paris, France. App. filed April 18, 1907. Has overlapping commutator segments which are connected in alternating relation to a battery terminal and to the induction coils of an ignition system. A flier or contact arm establishes communication while passing the overlapping portions.

896,240. COMPOSITION OF MATTER AND THE MANNER OF MAKING THE SAME; William A. Phillips, St. Louis, Mo. App. filed Sept. 12, 1907. A composition of matter for high-resistance conductors including fire clay impregnated with a conductor containing sulfids of iron and lead.

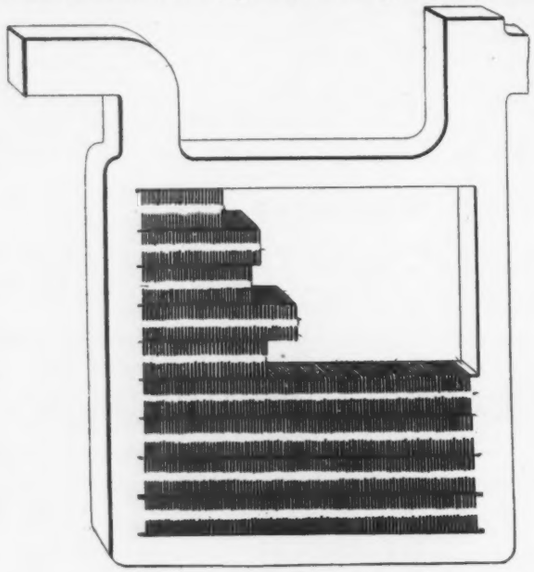
896,243. GAS OR VAPOR ELECTRIC APPARATUS; Max von Recklinghausen, New York, N. Y. App. filed Feb. 19, 1907. Has an oscillating lever within the vacuum chamber of a mercury-vapor

lamp and which is oscillated through a vertical barometer tube so as not to disturb the vacuum.

896,245. PROCESS OF EXTRACTING METAL FROM ORES; James H. Reid, Newark, N. J. App. filed Aug. 5, 1907. The process of extracting metals from ores which consists in successively subjecting the ore in vacuum to a series of different heating operations and condensing separately and independently the metals sublimed in each.

896,249. ELECTRIC MOTOR CONTROL; Girard B. Rosenblatt, Butte, Mont. App. filed Dec. 27, 1906. In a system of electric motor control, the combination of two synchronous motors and means for mechanically coupling the motors together, and a controlling means operative to associate the motor circuits only when the motors are coupled together.

896,252. MEANS FOR ATTACHING METALLIC FILAMENTS TO THEIR CARRIER-ARMS; Johannes Schilling, Halensee, Germany.



896,350.—Storage Battery Element.

App. filed Oct. 10, 1906. A means for supporting the filaments of tungsten, tantalum lamps, including a plurality of bows of such a character as to reduce the character of cement joints.

896,274. ARC-LAMP; Guy N. Chamberlin, Lynn, Mass. App. filed Dec. 21, 1906. Has an arc inclosing globe, means for supplying air to said globe, and means for causing the rate at which air is supplied to be automatically varied after one of the electrodes has been consumed a predetermined amount.

896,297. ELECTRIC HEATER; Edward M. Hewlett, Schenectady, N. Y. App. filed April 27, 1907. A resistance element for electric heaters, including sheet metal slotted in a zig-zag form and supported by central studs adapted to permit expansion. The resistance elements are stamped and folded in a peculiar way to provide a compact construction.

896,300. ELECTRICAL TESTING INSTRUMENT; Cameron DeWitt Jarvis, Winthrop, Mass. App. filed June 19, 1907. A pocket testing device for roughly determining differences of potential. Makes use of an electric lamp in the resistance in series therewith. Particularly for use in testing telephone circuits.

896,319. CURRENT COLLECTOR FOR ELECTRIC RAILWAYS; Philipp Pforr, Lankwitz, near Berlin, and Paul E. Herkner, Berlin, Germany. App. filed Jan. 23, 1907. Makes use of a pair of current collectors independently controlled by pneumatic systems. Has means for controlling a pneumatic system operating by the reversal switch of the train so that the direction of the current collectors is automatically changed with changes in the direction of the vehicle.

896,321. FIELD MAGNET STRUCTURE; Henry G. Reist, Schenectady, N. Y. App. filed June 12, 1905. The field magnet laminæ are assembled with laminated pole sections which are secured thereto by rectangular rods or bolts also formed of laminated iron.

896,322. DYNAMO ELECTRIC MACHINE; Henry G. Reist, Schenectady, N. Y. App. filed July 10, 1903. A rotary field magnet construction for turbo-generators designed to hold the laminations with adequate security and provide proper ventilation. Has the laminæ assembled in groups and bound together by transversely extending rods.

896,323. DYNAMO ELECTRIC MACHINE; Henry G. Reist, Schenectady, N. Y. App. filed July 10, 1903. A construction of rotor for dynamo electric machines of the multipolar type, made up of U-shaped stampings which are bolted together to form a ring with projecting poles.

896,341. FILAMENT FOR INCANDESCENT LAMPS; Willis R. Whitney, Schenectady, N. Y. App. filed Nov. 14, 1904. A filament for incandescent lamps formed substantially of a nitrid of a rare earth metal.

896,348. CIGAR LIGHTER; Eskil Berg, Schenectady, N. Y. App. filed April 26, 1907. Makes use of a resistance element within a chamber inclosed with a mica shield having perforations. The heated air from the chamber is blown through the chamber and ignites the cigar.

896,350. STORAGE BATTERY ELEMENT; John Bimeler, Zoar, Ohio. App. filed Feb. 13, 1908. A construction of element for a storage battery comprising a suitable openwork frame and a plurality of pieces having leaf formed active sides arranged one above the other in the same plane as said frame and unified with the frame at their ends, said active sides being superposed and at right angles to the sides of the element as a whole.

896,397. PENCIL AND APPARATUS FOR PRODUCING THE ARC LIGHT; Isador Ladoff, Cleveland, Ohio. App. filed Sept. 23, 1907. In an apparatus for producing the arc light a position pencil or electrode comprising copper and a titanic material.

896,400. BLACKLEADING MACHINE; Frank J. Learman, Buffalo, N. Y. App. filed May 11, 1908. A spout actuated mechanism for use in electrotype work for coating wax matrices with black lead. Has a universal movement over the surface of the electrotype plate.

896,402. AUTOMATIC ENGINE STOP; Nathaniel C. Locke, Salem, Mass. App. filed Aug. 6, 1907. The engine has a steam throttle valve with a relief valve and an electro-mechanical relief valve controller having a controller valve exposed to steam pressure for lifting it.

896,413. APPARATUS FOR EXTRACTING METALS FROM ORES; James H. Reid, Newark, N. J. App. filed Aug. 5, 1907. Has a treating chamber, and inclosing means therefor extending about the same, and means for creating a vacuum therein.

896,417. ARC LAMP; Ralph Scott, Wilkes-Barre, Pa. App. filed June 1, 1905. Provides an arc lamp with a steadying resistance formed of bare German silver wire which is wound into a coil and baked until red hot, so as to form an insulating oxide. This steadying resistance coil also operates magnetically to regulate the arc.

896,429. ELECTRODE FOR ELECTRIC FURNACES; Frederick M. Becket, Niagara Falls, N. Y. App. filed Dec. 22, 1906. An electrode having a metallic body portion the interior of which is hollow or chambered with an exterior coat or shell of carbon.

896,469. MAGNETIC CIRCUIT BREAKER; Ralph Scott, New Brunswick, N. J. App. filed March 3, 1906. A form of circuit breaker adapted to fit upon a panel board without taking up substantially more room than the usual cartridge fuses. Among other features has a pair of carbon blocks with pitted faces between which the final circuit rupture takes place, the air confined in the cavities serving to quickly disrupt the arc.

896,516. MOTOR CONTROL SYSTEM; Herbert W. Cheney, Norwood, Ohio. App. filed July 12, 1906. Electric controllers for three-phase induction motors. Has a starting controller for each motor so arranged with a number of different motors which may be started in turn by the same starting controller. Has a system of interlocks for preventing careless handling of the controller.

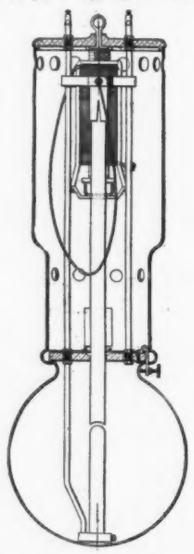
896,554. HEATER; Anna I. D. Kyle, Aberdeen, S. D. App. filed April 14, 1908. Makes use of a spherical chamber in which resistance coils are contained together with an electric motor having fans which impel a circulatory current through the coils.

896,555. ELECTROLYTIC CELL; Gilbert C. Landis, York, Pa. App. filed Sept. 17, 1907. The elements of a cell are designed for the electrolyte manufacture of chlorates so as to permit their ready assembling or removal and permit the capacity of the cell being conveniently increased or diminished as desired.

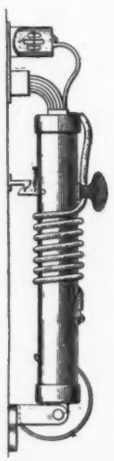
896,584. ELECTRICAL APPARATUS FOR TRANSMITTING SIGNALS; Charles Salmon and Henry J. Creffield, Erith, England. App. field Oct. 23, 1906. Covers specific details of a signaling apparatus for gunnery purposes intended for transmitting information of various sorts from the conning tower of a ship to a number of receiving instruments.

896,586. MAKE AND BREAK DEVICE; Dominic Sandretto, Ladd, Ill. App. filed June 22, 1908. A make and break device for operating light machinery, such as clocks. Designed to automatically keep the contacts clean.

896,608. ARRANGEMENT OF THE WINDING OF ELECTRO-MAGNETIC CLUTCHES; Heinrich Ast, Vienna, Austria-Hungary. App. filed June 15, 1906. The winding of a magnetic clutch is contained in an annular recess in a special frame which has air passages for the purpose of ventilation.



896,417.—Arc Lamp.



896,469.—Magnetic Circuit Breaker.

896,617. TELEPHONE SWITCHBOARD APPARATUS; Lewis A. Brinkman, Chicago, Ill. App. filed Feb. 8, 1904. In a telephone switchboard, the combination with an operator's key shelf, of a main plate adapted to be secured to the upper surface of said key shelf, a plurality of small plates secured to the upper surface of said main plate, and a plurality of operators' keys adapted to be individually secured to or removed from said plates without the removal of the main plate from the switch-hook, substantially as described.

896,698. ARC LAMP; Charles P. Steinmetz and John T. H. Dempster, Schenectady, N. Y. App. filed Nov. 16, 1903. A lamp construction in which but one of the electrodes is movable and in which the electrodes are particularly designed for flaming arcs. Has means for causing the electrode to move through a fixed distance when displaced by gravity and an electromagnet for moving it in the opposite direction.